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Editorial Policy

The primary purpose of the JTM is to publish managerial and policy articles that are relevant to academics, policymakers, and practitioners in the transportation, logistics and supply chain fields. Acceptable articles could include conceptual, theoretical, legal, case, and applied research that contributes to better understanding and management of transportation and logistics. Saying that, our policy requires that articles be of interest to both academics and practitioners, and that they specifically address the managerial or policy implications of the subject matter. Articles that are strictly theoretical in nature, with no direct application to transportation and logistics activities, or to related policy matters, would be inappropriate for the *JTM*. Articles related to any and all types of organizations, and of local to global scope, will be considered for publication.
Acceptable topics for submission include, but are not limited to, broad logistics topics, logistics and transportation related legal issues, carrier management, shipper management of transportation functions, modal and intermodal transportation, international transportation issues, transportation safety, marketing of transportation services, transportation operations, domestic and international transportation policy, transportation economics, customer service, and the changing technology of transportation. Articles from related areas, such as third party logistics, purchasing and materials management, and supply chain management, are acceptable as long as they are related to transportation and logistics activities.

Submissions from practitioners, attorneys or policymakers, co-authoring with academicians, are particularly encouraged in order to increase the interaction between groups. Authors considering the submission of an article to the *JTM* are encouraged to contact the editor for help in determining relevance of the topic and material.

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Publishing Data

Manuscripts. Submit manuscripts to the editor by email attachment at taylorjohn@wayne.edu. Manuscripts should be no longer than 30 double-spaced pages and 7000 words. Guidelines for manuscript submission and publication can be found in the back of this issue.

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Revised September 15, 2010

From the Editor...

Welcome to the Fall/Winter, 2011 issue of the Journal of Transportation Management!

This issue of the *Journal* contains five articles on various aspects of trucking safety legal issues, logistics strategy impacts across three cultures, LTL pricing, and airline concentration and aviation fuel efficiency. The first article is a legal commentary that focuses on the state of safety related legal affairs in the motor carrier industry, and specifically examines the "duty of reasonable care" doctrine in light of FMCSA's administration of CSA. The article goes on to make several recommendations for shippers and policymakers. The second article examines logistics strategy's impact on coordination, customer service and competitive responsiveness across companies in three distinct countries. The article concludes that the Bowersox/Daugherty typology under study is a useful approach to examining logistics strategies in different countries.

The third article focuses on LTL pricing and reports on the findings from in-depth interviews of industry stakeholders on the topic of satisfaction with current LTL pricing approaches. The article confirms a long held dislike for the current class rate system, finds strong support for changing the system, and suggests that a density based system is the most likely alternative. The fourth and fifth articles relate to the aviation industry. The fourth article reports on passenger airline concentration levels and summarizes increasing levels of concentration since deregulation. The article goes on to report on evidence of industry economies of scale and discusses the implications of such economies. The final article examines the role that fuel efficiency can play in providing competitive advantage in the aviation industry. The article concludes that competitive advantage can be particularly powerful if a culture of fuel efficiency can be embedded in the organization.

At the *Journal*, we are continuing to make a number of changes that will improve the visibility of JTM, and improve its position in the supply chain publishing world. These include registering and updating journal information with several publishing guides, placing the journal content with the EBSCO, Gale and JSTOR databases faculty have access to, and placing abstracts of all past journal articles on an open area of the Delta Nu Alpha Journal web page. We are in the process of uploading all past issues to these various sites. Full journal article PDF's continue to be available to subscribers on the web page at www.deltanualpha.org with the password: dna4education.

I look forward to hearing from you our readers with questions, comments and article submissions. The submission guidelines are included at the end of this issue's articles and I encourage both academics and practitioners to consider submitting an article to the Journal. Also included in this Issue is a subscription form and I hope you will subscribe personally, and/or encourage your libraries to subscribe.

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A COMMENTARY:
THE PERFECT STORM: SCHRAMM DECISION, FMCSA, AND AN IMPOSIBLE DUTY FOR BROKERS AND THIRD PARTY LOGISTICS COMPANIES

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Attorney at Law

ABSTRACT

Over the last thirty years, there never has been a more confused doctrine than the current "duty of reasonable care" faced by transportation brokers, third-party logistics companies and shippers as they select carriers for transport. The confusion in what was once reasonable and well understood law has been fueled by a perfect storm of judicial reasoning with misplaced reference to faulty empirical data, the complete failure of the Federal Motor Carrier Safety Administration (FMCSA) to properly assess carrier safety worthiness, a feeding frenzy by the plaintiffs' bar and apathy by many in the industry. The purpose of this commentary is to examine how this uncertainty developed, to identify some of the more glaring issues that must be addressed, and to give some possible guidance as to how the industry, FMCSA and courts should proceed to clarify the duty of a broker in complying with "reasonable care" in selecting carriers.

INTRODUCTION

During thirty years as a transportation attorney, general counsel to three third-party logistics companies and former CEO of a logistics company, there never has been a more confused doctrine than the current "duty of reasonable care" faced by transportation brokers, third-party logistics companies and shippers as they select carriers for transport. The confusion in what was once reasonable and well understood law has been fueled by a perfect storm of judicial reasoning with misplaced reference to faulty empirical data, the complete failure of the Federal Motor Carrier Safety Administration (FMCSA) to properly assess carrier safety worthiness, a feeding frenzy by the plaintiffs' bar and apathy by many in the industry in the face of some potentially serious challenges to the future of competition in both the carrier and broker sectors of the industry.

The purpose of this commentary is to examine how this uncertainty developed, to identify some of the more glaring issues that must be addressed, and to give some possible guidance as to how the industry, FMCSA and courts should proceed to clarify the duty of a broker in complying with the "reasonable care" standard for selecting carriers.

Since the inception of the property broker concept, brokers have for the most part been held to a very limited duty of reasonable care and diligent inquiry in the selection of carriers for transport. As will be shown, the wisdom of fifty years of state and federal courts construing this duty to be limited is much more well-founded than the more recent and patently unsound extensions of this duty, requiring brokers to be an ombudsman of safety determinations in lieu of the FMCSA.[1] For all of the twentieth century a broker's duty with slight exception was usually construed to mean that

[1] *SeeChubb Group of Insurance Companies v. H.A. Transportation Systems, Inc.*, 243 F. Supp. 2d 1064 (C.D. Cal. 2002); *CGU Int 'l Ins., PLC v. Keystone Lines Corp.* , 2004 WL 1047982, *3 (N.D. Cal. May 5, 2004); *Schramm v. Foster,* 341 F. Supp. 2d 536 (D. Md. 2004); *Jones v. C.H. Robinson Worldwide, Inc.* 558 F. Supp. 2d 630.

brokers had to confirm that carriers they hired satisfied the following requirements:

> 1. Authorized by what is now the FMCSA;
> 2. Had regulatory mandated minimum insurance coverage; and
> 3. Were competent insofar as any knowledge the broker had or with reasonable care could ascertain.[2]

Perhaps the *Foster* case[3] in 1969 was the first real inroad into a broader duty by brokers. It was clearly a precedent for some of the very vague, ambiguous and judicial activist reasoning and extremely poor direction by the Maryland district court in the *Schramm* case. The *Schramm* case, and its mandate that brokers/third party logistics companies must look to a data base (FMCSA's Safety Status Measurement System, "SafeStat") that was full of error, and invalid as a predictor of carrier safety worthiness, pivoted off of *Foster*. It required that brokers look to a source that could only create continued confusion for brokers and shippers, since both the SafeStat system and its successor, Safety Management System (SMS), have been shown to provide misleading and incomplete information from which it is virtually impossible to determine carrier safety worthiness, as will be more thoroughly discussed herin.

If one is to properly address the current enigma faced by brokers in their "new" duty of reasonable care in selecting carriers, decision-makers must understand how the fallacy of this new duty was developed, with some hope that a better understanding of this unfortunate rule of law will be completely corrected.

ANALYSIS

I. The *Foster* Case and How it Was Bad Law and a Faulty Foundation for *Schramm*

The *Foster* case involved a shipper (Foster) who had selected a carrier that was involved in an automobile accident in which persons were seriously injured, after the brakes on the carrier's truck failed. Plaintiffs, in addition to statutory and regulatory infractions that are not pertinent, alleged that the broker was negligent for selecting "...an incompetent and careless contractor (carrier)". The Ninth Circuit Court of Appeals reasoned first that the evidence was insufficient to hold that Foster could have known of prior acts of negligence by the carrier of such number or magnitude to have found the carrier to be incompetent or careless. They also found that Foster had no actual knowledge of either poor reputation or lack of authority on the part of the carrier.[4]

Had the Court stopped there, as they should have, the ambiguous reasoning and inexplicable duties for brokers pronounced in the *Schramm* (2004) case perhaps would never have been visited upon the truck brokerage industry. The *Foster (1969)* court could have followed the conclusion reached in *Mooney v. Stainless, Inc,* a 1964 case out of the Sixth Circuit Court of Appeals.[5]

> ...we believe the better rule to be that in order to render an employer liable under the theory of negligent selection of an independent contractor in cases such as the one at bar, it is necessary to establish that, at the time of hiring, the employer had either actual or constructive knowledge that the independent contractor was incompetent.[6]

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[2] *L.B. Foster Company v. Hurnblad*, 418 F. 2d 727, 730 (9th Cir. 1969)
[3] *Id.*
[4] *Foster,* at 730, 731.
[5] 338 F. 2d 127 (6th Cir. 1964)
[6] *Id.* at 131

In addition, the mere fact that an independent contractor might subsequently engage in a negligent act raises no presumption that the employer was negligent in selecting the independent contractor for the job.[7]

Instead, as in so many cases where it seems that legal reasoning is replaced with the purpose of sustaining a sympathy verdict, the *Foster* court found that where direct evidence of negligence is missing, a jury can *infer negligence* by a "...carrier's or transportation broker's lack of experience, poor financial condition, failure to respect certificate requirements, and willingness to do business at cut rates."[8] From this premise, notwithstanding a total lack of affirmative proof of incompetence, or prior negligence, the Court went on to find that Foster "...failed to make a reasonable inquiry as to [the carrier's] competence."[9]

If we are to understand the fallacy of the new duty of due care placed upon brokers by the *Schramm* court (and courts that have followed), we must first realize that *Foster* was the *only case cited* by *Schramm* as a premise for the "new" duty of reasonable care and standard for "reasonable inquiry". Also, since the *Foster* case was apparently the first court decision to supplant direct evidence of prior knowledge of carrier negligence with *inference of negligence* based upon the business acumen and financial sufficiency of the carrier, we must test that logic against our own fair analysis, before moving on to the failure of the *Schramm* court's reasoning in establishing an impossible standard of care.

Return to *Foster*, and recall that the *Foster* court found no direct evidence of negligence by the shipper in selecting the carrier, but ruled instead that negligence could be inferred by the shipper failing to make reasonable inquiry into the "...carrier's or transportation broker's lack of experience, poor financial condition, failure to respect certificate requirements, and willingness to do business at cut rates."[10] Assume *arguendo* that a broker finds a carrier for which he knows of no prior negligence or incompetence. The broker then finds that the carrier has the following characteristics:

1. The carrier is new and may have the best drivers and equipment in the business, but because the carrier is new, there exists a "lack of experience".
2. Has some weak financials, as all start-ups and many solid performance carriers do, thus is currently in "poor financial condition".
3. Has certificates of authority that may be conditional because they are new, or may have lapsed because of administrative inefficiency.
4. Is willing to cut rates in order to gain business, as will many very safe carriers who have a "willingness to do business at cut rates".

Assume further that the broker contracts with this carrier to deliver a load, knowing of no prior acts of negligence and finding that the carrier is not rated as "Unsatisfactory" by the FMCSA. After the carrier accepts the load, there is a horrible accident caused by the driver falling asleep. For the broker in our hypothetical, and the entire broker industry, how can any of the standards put forward by the *Foster* case help, or fairly be considered, in looking for the proximate cause of this accident, or finding that

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[7] *Mooney*, at 131, citing *Matanuska Electric Association, Inc. v. Johnson*, 386 P. 2d 698 (Alaska); Strickland v. State, 13 Misc.2d 425, 177 N.Y.S.2d 983; *Eger v. Helmar*, 272 Mich. 513, 262 N.W. 298; *Silveus v. Grossman*, 307 Pa. 272, 161 A. 362; 27 *Am.Jur* (Independent Contractors) 509

[8] *Foster, supra* at 730

[9] *Id.* at 731.

[10] *Id.*

the selection of the carrier by the broker was negligent. The answer is that such standards are of highly subjective quality and couldn't possibly be helpful in the absence of direct proof of broker negligence. However, when courts allow juries to *infer* negligence from such weak logic, juries will too often create a path to a sympathetic verdict. Such standards are contradictions of sound judicial reasoning, which have in the past required direct evidence that the broker had actual or constructive knowledge that the carrier was incompetent, before attributing to the broker culpability for negligent hiring.

The *Foster* court cited no authority for their highly subjective standard for reasonable inquiry. As in most bad law, they reasoned backward to reach their result, by giving us a checklist of business acumen, rather than a solid inquiry standard. The suggested list of criteria for an inference of negligence is immediately exposed as fallacious when made a part of the following:

- All carriers having poor financials and willing to do business at cut rates are negligent
- Carrier "A" has never had an accident until now, has poor financials, lack of experience and is willing to do business at cut rates.
- Therefore, Carrier "A" must be negligent.

One does not have to be an expert in argument form to see how this syllogism stands out as invalid. Further, other courts have considered this very argument and correctly found that business acumen and financial responsibility have no place in such analysis.

> As to the first point, we reject the notion that financial irresponsibility is either equivalent to or a category of incompetence. *Cassano v. Aschoff*, 226 N.J.Super. 110, 116, 543 A.2d 973, certif. denied, 113 N.J. 371, 550 A.2d 476 (1988); see also Restatement (Second) of Torts § 411 comment g (1965) ("The rule stated in this Section makes the employer responsible only for his failure to exercise reasonable care to employ a contractor who is competent and careful. It has no application where the contractor, although competent ... is financially irresponsible.").[11]
>
> Equating lack of insurance and financial responsibility with incompetence might also wreak havoc in particular industries, *such as transportation*, because persons or entities contracting for transportation services would be required to make continuing inquiry into the financial qualifications of the contractor.[12] [emphasis added]

Foster was bad law. However, it was clearly the faulty foundation for worse law by the *Schramm* court, thirty-four years later. Both *Foster* and *Schramm* are seemingly examples of how bad law is often created by courts looking for social justice where a tragic accident has occurred, or reaching too far in creating a duty that has not heretofore existed. They both remind us of Justice Holmes' often mis-paraphrased comment, "Great cases like hard cases make bad law. For great cases are called great, not by reason of their real importance in shaping the law of the future, but because of some accident of immediate overwhelming interest which appeals to the feelings and distorts the judgment."[13]

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[11] *Mavrikidis v. Petullo*, 153 N.J. 117, 707 A.2d 977 (N.J.,1998).
[12] *Id.* at 139, citing *Robinson v. Jiffy Executive Limousine Co.*, 4 F 3d 237 at 242.
[13] *Northern Securities Co. v. United States* 193 U.S. 197, 400-401.

II. The *Schramm* Court Rules that Brokers Must Reference an Invalid Database (SafeStat).

The *Schramm* case, involved an accident in the state of Maryland, caused when the carrier failed to stop at an intersection and plaintiffs' automobile collided with the carrier's vehicle. Injuries to the plaintiffs were catastrophic and permanent. The Maryland District Court considered a motion for summary judgment and granted all parts of the motion, except for that part relating to negligent hiring of the carrier by the broker.With the seed of illogical "reasonable inquiry" planted by *Foster*, what followed was the *sine qua non* for the *Schramm* court to give us the new and intractable duty for transportation brokers:

> This duty to use reasonable care in the selection of carriers includes, at least, the subsidiary duties (1) *to check the safety statistics and evaluations of the carriers with whom it contracts available on the SafeStat database maintained by FMSCA*, [italics mine] and (2) to maintain internal records of the persons with whom it contracts to assure that they are not manipulating their business practices in order to avoid unsatisfactory SafeStat ratings.[14]

Perhaps the *Schramm* court was looking at least in part for a more objective standard of reasonable inquiry than what they saw in the *Foster* decision. Perhaps they saw the same inadequacy in such a business acumen test as demonstrated here. However, they unknowingly resorted to requirements that could not produce a more reliable result when followed. In fairness to the *Schramm* court, they apparently did not know that their effort at a more objective standard of reasonable care was doomed by the completely inadequate authority they chose for inquiry into carrier safety, i.e., "... the SafeStat database maintained by FMSCA."

In fact, these "subsidiary duties" were on the day announced counterproductive to any notion of improving the process of selecting safe carriers. Furthermore, the sanction of such a useless process by a federal district court both greatly confused the former duty of reasonable care for transportation brokers, and at the same time allowed FMCSA to further avoid its duty to be the one and only entity to administer, evaluate and determine carrier safety worthiness. Consider the first "subsidiary duty" announced by the district court:

> "(1) to check the safety statistics and evaluations of the carriers with whom it contracts available on the SafeStat database maintained by FMSCA." [15]

To scrutinize fairly the rationale by which the *Schramm* court pronounced this duty, one must ask: What would the broker in the *Schramm* case have found had they looked carefully at SafeStat, prior to selecting the carrier involved in the ensuing accident? The accident and concomitant duties of the broker which were the subject of the court's analysis occurred on May 2, 2002, and the court's decision was announced August 24, 2004. For the interim period between the date of the accident and the court's analysis requiring brokers to look to the SafeStat system, the U.S. Department of Transportation, Office of Inspector General reported the following on February 13, 2004:

1. Of 645,551 active interstate carriers on record, only 26 percent had sufficient data represented to compute a value for one or more of the four safety evaluation areas.

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[14] *Schramm* at 551, citing *Foster*, supra.

[15] *Schramm, supra*

2. One-third of crash reports, including 37,000 crashes involving interstate carriers, were missing from the FMCSA's database.
3. As of January, 2003, 42 percent of the reporting on active carriers contained outdated data.
4. For the fiscal year 2002, the average time in which to upload crash data on carriers took 158 days.
5. Thirteen percent of the 21,000 crashes and over 70,000 of the inspection transactions occurring in our 6-month sample period contained carrier identification errors, such as failure to identify a carrier associated with the violation, or in a smaller number of instances, identifying the wrong carrier.
6. In an estimated 11 percent of the inspection errors the wrong carrier was held accountable for the SafeStat related violation.
7. Problems with the inaccurate data are compounded because no effective system is in place now to facilitate the correction of errors in data reporting.
8. Missing crash reports may place a lower risk carrier in a deficient category because data for a higher risk carrier is not included in the calculation.
9. The effectiveness of the SafeStat scoring and ranking calculations is highly dependent on the quality of the crash data file, which in the past was missing a substantial number of reportable crashes.
10. If public dissemination of SafeStat results is to continue, the data must meet a higher standard. The types and magnitude of data problems we found argue for immediate and effective action.[16]

Perhaps the *Schramm* court was somehow ruling on insufficient or poorly presented evidence, or took unfounded rationale without precedent from briefs by the parties, but for unknown reasons and no proven prior validity, the court created a "subsidiary duty" *sui generis,* that was, by objective facts then available, contrary to any notion of best practice. Moreover, this newly announced duty made it mandatory for brokers to look to a source (SafeStat) that had been found to be unreliable by the Inspector General's office six months before the *Schramm* decision was published. In fact, the Inspector General's report was clearly saying that the data was incomplete, invalid as an indicator of accurate reporting on carriers and recommending that the SafeStat site be taken out of public view and use months before the *Schramm* court mandated its use.

Seemingly, the *Schramm* court was desperate for an empirical source to which brokers and other shippers could turn and get a clear indication of the safety worthiness of carriers. They apparently assumed far greater validity for the information to be found on SafeStat than existed. With all of the information that was available at the time of their decision, they either knew or should have known that SafeStat was anything but a failsafe source of carrier safety evaluation. Still, inexplicably, they created a standard that was immediately incapable of confirming "reasonable care" or "diligent inquiry", since the source to which the court directed brokers could not possibly provide completely valid information, and thus, absolutely could not be reliable, by definition.

(The reader is invited to test this conclusion against any of the ten findings mentioned above

[16] U.S. Department of Transportation, Office of Inspector General: *Executive Summary Audit Report No. MH-2004-034, February 13, 2004;* http://www.oig.dot.gov/sites/dot/files/pdfdocs/mh2004034.pdf

in the Inspector General's audit of 2004; *e. g.*, if 11 percent of the inspection errors were attributed to the wrong carrier, how may we *reliably* make any determination as to the carrier we are researching? If 74% of the registered carriers did not have sufficient data represented, how was the broker in *Schramm* to know with *reliability* whether the carrier they were researching was among them? If in 11 percent of the inspection errors the wrong carrier was held accountable for the SafeStat violation, how was the broker to know whether the carrier they were researching was among these wrongfully charged with a violation.)

All indications of the unreliable nature of SafeStat continued to mount from the time of the *Schramm* decision. By 2007, the Inspector General made the following findings and recommendations:

- We found that, although improvements have been made, problems still exist with the reporting of crash data.
- Completeness of data is critical for SafeStat because scoring involves a relative safety ranking of one carrier against other carriers competing for the same business.
- Missing crash reports may place a lower risk carrier in a deficient category because data for a higher risk carrier is not included in the calculation. Consequently, FMCSA should continue to limit public use until it can assess whether significant crash reporting problems remain.
- Before FMCSA allows public access to SafeStat scores, it must improve its ability to measure the completeness of non-fatal crash reporting.[17]

Shortly after the Inspector General reported this information to Congress; on February 21, 2008, the FMCSA put the following disclaimer (in part) on the SafeStat website:

"Caution Urged in the Use of SafeStat Data"

The message that followed this notice included a description of how information was reported to the FMCSA and problems with variation in that data reporting. The description was summarized with this statement:

> "Accordingly, SafeStat's ability to accurately and objectively assess the safety fitness of individual motor carriers *may be inconsistent and not conclusive without additional analysis."* [emphasis added]

This announcement confirming the invalidity of the SafeStat information on carriers was then followed by this boldfaced disclaimer:

> *WARNING*
> *Because of State data variations, FMCSA cautions those who seek to use SafeStat data analysis system in ways not intended by FMCSA. Please be aware that use of SafeStat for purposes other than identifying and prioritizing carriers for FMCSA and state safety improvement and enforcement programs may produce unintended results and not be suitable for certain uses.*[18]

In the same year that the *Schramm* decision was published, the Inspector General's Office concluded that SafeStat was no longer a valid measurement device for carrier safety worthiness: "FMCSA must act to revalidate the SafeStat model because changes have occurred

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[17] U.S. Department of Transportation, Office of Inspector General: *Letter from Inspector General Scoval to Congressman Petri with attached Briefing, June 19, 2007: http://www.oig.dot.gov/sites/dot/files/pdfdocs/SAFESTAT.PDF*

[18] FMCSA, *Safety Measurement System, http://ai.fmcsa.dot.gov/SMS/*

since the 1998 study that supported the model's validity."[19]

The *Schramm* court established a rule of law that was clearly wrong on the date it was announced. No clear and reliable safety determination was available to the broker in *Schramm* had they "... check[ed] the safety statistics and evaluations of the carriers with whom it contracts available on the SafeStat database maintained by FMSCA", nor was one available to all the brokers henceforth that have been irresponsibly burdened by this decision, which is inexplicable except for the motive of reaching a social justice decision. The FMCSA reporting function that had been a failure since its inception in 1999, was a failure prior to and on the date of the *Schramm* decision, and continues to be a failure to this day, even its present form known as Comprehensive Safety Analysis 2010 (CSA 2010), Safety Management System (SMS), as later developed here.

In summary, the SafeStat measurement system of carrier safety was invalid and unreliable at the time of the ruling in *Schramm.* However, due to a lack of a careful and cogent analysis, courts and court decisions have continued to allow juries to consider the incredulous notion that brokers should have looked to the SafeStat system for information on carriers as a part of their duty of reasonable care in selecting a carrier.[20] Perhaps more important, the unusual mandate by a federal court, giving specific direction to such an unreliable source, has been accepted as procedure that must be followed by many who counsel transportation brokers on risk management, and cottage industries have been created to look for and evaluate information that is by any definition unreliable.

III. FMCSA Replaces Safer/SafeStat with Comprehensive Safety Analysis 2010 (CSA 2010) and the Safety Management System (SMS).

The problems with SafeStat and continued public outcry, along with Congressional oversight and pressure, resulted in the FMCSA announcing the agency function that was to replace SafeStat as a carrier safety measurement system. In their Five-Year Plan for 2006-2011, the agency provided the first description of CSA-2010:

> The intent of CSA 2010 is to establish an operational model that will determine the relative safety fitness risk attributable to every motor carrier and develop streamlined approaches to change the behavior of poor motor carrier operations and their drivers. The CSA 2010 will ultimately provide FMCSA a new modern-operational model that will greatly enhance the Agency's efficiency at gathering and properly evaluating a greater proportion of the regulated population.[21]

This intent was followed by the rollout of the CSA 2010 Operational Model, in December, 2010, with the following stated purpose: "CSA re-engineers the former enforcement and compliance process to provide a better view into how well large commercial motor vehicle carriers and drivers are complying with safety rules, and to intervene earlier with those who are not."[22]

Since the inception of CSA 2010 and the SMS measurement categories for carrier safety, this

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[19] *Executive Summary Audit Report, supra.* p. iv. (2004).

[20] See, *Jones v. C.H. Robinson Worldwide, Inc.* 558 F. Supp. 2d 630.

[21] Federal Motor Carrier Safety Administration, *FMCSA Strategic Plan 2006-2011,* http://www.fmcsa.dot.gov/fmcsa-strategic-plan-102907.htm

[22] Federal Motor Carrier Safety Administration, *CSA - Compliance, Safety, Accountability, website http://csa.fmcsa.dot.gov/about/csa_how.aspx*

new alternative has also been found to be invalid and unreliable for such a purpose. The foundation for the conclusion that this measurement system is also invalid and unreliable for the purpose of determining carrier safety with reasonable certainty includes the following:

1. Anne Ferro, Administrator, FMCSA, stated before Congress that the FMCSA will replace SafeStat with the Safety Management System (SMS), and that the Agency can rate only between two and three percent of the carrier population annually.[23]
2. Because of skewed data and disproportionate impact on carriers, the National Association of Small Trucking Companies (NASTC), et al. filed suit against the FMCSA on November 29, 2010, seeking a stay on the implementation of SMS and its ostensible measurements of carrier safety (Behavior Analysis and Safety Improvement Categories "BASICs").[24]
3. In a settlement agreement between NASTC, et.al., and FMCSA, on March 4, 2011, the FMCSA, agreed to publish a disclaimer on the SMS website, admitting that,

   Readers should not draw conclusions about a carrier's overall safety condition simply based on the data displayed in the system. [emphasis added] Unless a motor carrier in the SMS has received an UNSATISFACTORY, safety rating pursuant to 49 CFR Part 385, or has otherwise been ordered to discontinue operations by FMCSA, it is authorized to operate on the nation's roadways.[25]
4. During the twelve months that SMS has been used by FMCSA to evaluate carrier safety, there have been numerous database changes, with the following noted as deficiencies in fairly rating all carriers within the test states:

- Only 11 percent of regulated carriers have any scores.
- Crash data includes both preventable and non-preventable accidents. Less than 4 percent of regulated carriers have crash data included.
- "Unsafe driving" scores are recorded only in conjunction with roadside inspections, and measure only 4.8 percent of the regulated carriers.
- The "fatigued driving" BASIC measures only 2.5 percent of the regulated carriers.
- "Vehicle maintenance" measures only 9 percent of the industry.
- "Driver fitness" measures only 2 percentof the industry. Most points are accumulated for drivers not having medical cards in their possession – not for actual disqualifying medical conditions.[26]

Such uncertainty and lack of validity to critical mass measurement of all regulated carriers has led to concern by financial institutions and the capital markets invested in the transportation

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[23] Committee On Transportation And Infrastructure Subcommittee On Highways And Transit U.S. House Of Representatives; *Statement of Anne S. Ferro, Administrator, FMCSA*;, June 23, 2010; http://www.fmcsa.dot.gov/about/news/speeches/Statement-of-Anne-S-Ferro062310.aspx

[24] *National Association of Small Trucking Companies, et al. v. FMCSA* (D.C. Cir. No. 10-1402)

[25] *Id.*, Settlement Agreement, March 4, 2011. Document ID:1297064

[26] U.S. Department of Transportation, Paul E Green and Daniel Blower, *Evaluation of the CSA 2010 Operational Model Test*, University of Michigan Transportation Research Institute, FMCSA-RRA-11-019 (Washington, D.C.: Aug. 2011), p. 27.

industry. One such company, Wells Fargo Securities, LLC, completed a thorough statistical analysis and reported their findings on November 4, 2011,

> In fact, according to our analysis of the 200 largest carriers in the CSA database, we find no meaningful statistical relationship between actual accident frequency and BASIC scores for Unsafe Driving, Fatigued Driving or Driver Fitness... we feel BASIC scores should not be used exclusively in assessing carrier risk and that they may, in fact, provide misleading information.[27]

Unfortunately, since the installation of CSA 2010 and its measurement devices for carrier safety contained within the SMS; brokers, shippers and carriers are left with another unreliable measurement system for carrier safety. While CSA 2010 and its measurement system, SMS, are the successors to SafeStat, no court has yet been required to rule on whether brokers have the duty to look to the carrier safety information within SMS. However, brokers operate daily under the threat of vicarious liability should they fail to follow the mandate of the *Schramm* Court, and "...check the safety statistics and evaluations of the carriers with whom it contracts available on the SafeStat database maintained by FMSCA."[28]

Never has a court offered any more meaningless and completely counterproductive direction. The paranoia and complete uncertainty surrounding the "new" duty of reasonable care for brokers in selecting carriers should never have come to be. It was originated by bad analysis, and over-reaching judicial direction to an invalid source of inquiry. The complete impossibility of this new duty of care has been exacerbated, rather than alleviated, by the bandwagon tendency for some who advise brokers to parrot the *Schramm* decision, and advise that brokers must "... check the safety statistics and evaluations of the carriers with whom it contracts available on the SafeStat database maintained by FMSCA". Rhetorically, and in fact, we must ask: To find what, exactly, which might be reliable?

It was bad advice when originated by the *Schramm* Court, for all the reasons outlined herein, and it is bad advice today. In light of all the information that has been generated and even the admissions of the FMCSA, for brokers to originate and perpetuate a business process that requires them "...to check the safety statistics and evaluations of the carriers with whom [they] contract..." on either the former SafeStat system, or its successor, the SMS, amounts to drinking the proverbial Kool-Aid. A better argument could perhaps be made that it is negligence *per se* for brokers to make a judgment about the safety worthiness of carriers from what has been demonstrated to be unreliable and certainly incomplete information currently found on the SMS. They will never be able to substantiate diligent inquiry by referring to bits and pieces of unreliable data.

How can such an inquiry satisfy any meaningful duty of due care, when the FMCSA directly contradicts such advice on the SMS website with their very clear disclaimer, "*Readers should not draw conclusions about a carrier's overall safety condition simply based on the data displayed in the system.*"[29] Further, as if the disclaimer is not enough, FMCSA adds in its explanation of what SMS is, and is not, "[t]he SMS results displayed on the SMS website *are*

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[27] *CSA: Good Intentions, Unclear Outcomes;* Anthony Gallo, CFA, Senior Analyst; Wells Fargo Securities, LLC, Equity Research Department, November 4, 2011

[28] *Schramm* , supra

[29] FMCSA, Safety Management System, http://ai.fmcsa.dot.gov/SMS/Data/carrier.aspx?enc=KxcVSWgEcay9s9SnBUikeRZByr+pUdovFGgZJQ18wgs=

not intended to imply any federal safety rating of the carrier pursuant to 49 USC 31144."[30] [emphasis added] That being so, we must ask was there ever any valid reason for brokers being sent into this nightmare of "checking safety statistics and evaluations of carriers"? The answer is clearly, no! It resulted from bad law and lack of understanding of just how completely invalid the information was at the bottom of the rabbit hole chosen by the *Schramm* Court.

IV. How Must This Folly Be Corrected?

By different means and methods, a strong consensus must be achieved by both courts and Congress that the FMCSA is the only entity charged with determining the relative safety of commercial carriers. The nonsense must end. Laypersons must not be charged with looking at experimental and, so far, invalid tools in a futile effort to somehow document "diligent inquiry" from information that by definition is unreliable as an indicator of current and complete information on all carriers (and therefore, on the carrier they are researching).

Congressional oversight of the FMCSA has been lacking in requiring of FMCSA proper accountability for their primary responsibility, at least since the introduction of the SafeStat system in 1999. No further Inspector General audits and warnings should be required before the FMCSA is either to admit that their responsibility cannot be achieved by current means, or completely sanction the rating of all carriers for which they have not made a determination of "UNSATISFACTORY", consistent with their own construction of their duty,

> Unless a motor carrier in the SMS has received an UNSATISFACTORY, safety rating pursuant to 49 CFR Part 385, or has otherwise been ordered to discontinue operations by FMCSA, it is authorized to operate on the nation's roadways.[31]

There is in this advisory an immediate dilemma for FMCSA if they, or the courts, suggest that brokers should not be limited in their duty of diligent inquiry to relying exclusively upon a search for an "Unsatisfactory" rating, or not. To suggest that a broker, with limited resources, must look into the maze of unreliable information, or infer relative safety from BASICs that may be distorted for all the reasons discussed herein, is to say that the broker (and the public) cannot rely upon FMCSA to authorize only safe carriers. Courts should in the future be reluctant to hold a broker, with limited understanding and reasons to believe that SMS data may be unreliable, culpable for selecting a carrier that has been authorized by FMCSA, with their vast investment in measurement systems with which to designate carriers as "authorized".

Title 49, U.S.Code § 31144, requires the Secretary of Transportation (delegated to FMCSA per 49 CFR 385) to:

> (1) determine whether an owner or operator is fit to operate safely commercial motor vehicles, utilizing among other things the accident record of an owner or operator operating in interstate commerce and the accident record and safety inspection record of such owner or operator –
>
> (2) periodically update such safety fitness determinations;

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[30] SMS Information Center, *What is the Motor Carrier Safety Management System (SMS)?*, http://ai.fmcsa.dot.gov/SMS/InfoCenter/default.aspx#question1.

[31] *SMS Website*, supra

(3) make such final safety fitness determinations readily available to the public;

There is no reasonable construction of this statutory language that would impose upon shippers, brokers and third-party logistics companies the duty of determining whether a carrier is safe. That is a statutory duty of the Department of Transportation, through the offices of their administrative agency, the FMCSA. There is no statutory or regulatory authority for the FMCSA to delegate this responsibility to members of the public who must choose a motor carrier from those registered with the FMCSA. There is no statutory or regulatory authority that allows a SafeStat or SMS measurement category (i.e., "BASICs") to be used as a "safety rating" in lieu of the procedure prescribed by 49 CFR 385, which by regulation mandates the statutory duty of the FMCSA to "make such *final safety fitness determinations* readily available to the public;"[32]

49 C.F.R. § 385.1 Purpose and Scope, provides:

(a) This part establishes FMCSA's procedures to determine the *safety fitness* of motor carriers, to assign *safety ratings*, to direct motor carriers to take remedial action when required, and to prohibit motor carriers determined to be unfit from operating a CMV. [emphasis added]

If we are to understand the confusion that has been created by the FMCSA and exacerbated by some courts, we must understand the difference between this clear statutory duty and what has resulted by years of FMCSA focus on safety management controls, as a means of achieving the ultimate objective and statutory duty to provide "*final safety fitness determinations*"[33], i.e., assign safety ratings.

These helpful distinctions are made at 49 C.F.R. § 385.3 **Definitions and acronyms**:

- *Safety fitness determination* means the final determination by FMCSA that a motor carrier meets the safety fitness standard under §385.5
- *Safety rating* or *rating* means a rating of "Satisfactory", "Conditional" or "Unsatisfactory", which the FMCSA assigns to a motor carrier using the factors prescribed in § 385.7

FMCSA database measurement tools such as the former SafeStat, or the current SMS, are not *safety fitness determinations* or *safety ratings*. They are measurement tools that remain under development toward validity and reliability. They should be viewed as such in the future by courts considering the admissibility of such uncertain data. While they are under development, and until completely valid, they should not be viewed by the public in lieu of or in search of a statutorily required *safety rating*. [emphasis added]

The former SafeStat and current SMS measurement categories have been proven to be nothing more than incomplete attempts to gather metrics with which the FMCSA can make fitness determinations and safety ratings. THEY ARE NOT COMPLETED SAFETY RATINGS! It follows that when such tools are of questionable validity and reliability, they should be kept from the public view, rather than be mistakenly designated by courts as sources to which brokers must look. To do so would avoid the many dire consequences brought about by misleading the shipping public, and the courts that have misguidedly given these invalid tools undeserved credence as part of common law duties.

[32] 49 U.S. Code § 31144 (3)
[33] *Id.*

A. Suggested Congressional Action

The FMCSA has completely failed to fulfill the statutory and regulatory duty of providing to the public accurate and timely safety ratings on all registered carriers. This failure is glaring and complete, since the inception of the FMCSA in 1999. There has never been a time, since the inception of the FMCSA, that they have been able to publish a "final safety fitness determination" for all, or even a significant portion of the active interstate motor carriers. As of December 23, 2011, the FMCSA reports:

- 792,704 active interstate motor carriers, with 118,327 (14.92%) of these having a safety rating of either Satisfactory, Conditional, or Unsatisfactory.
- 338,380 For Hire interstate motor carriers, with 61,067 (18%) of these having a safety rating of either Satisfactory, Conditional, or Unsatisfactory
- 454,324 Private interstate motor carriers, with 57,260 (12.6%) of these having a safety rating of either Satisfactory, Conditional, or Unsatisfactory[34]

Since Administrator Anne Ferro states that the FMCSA can only rate two or three percent of the motor carriers annually[35], it is unknown how many of these are current, but by mathematical certainty, many are so old they are meaningless as far as current safety worthiness. While spending $45 million on CSA 2010 since 2007, and requesting $78 million for 2012,[36] the FMCSA has created new measurement categories for "intervention" (of questionable validity and reliability), but has not created a system that can give a definitive and final Safety Rating on all registered carriers. Their delegated duty, under 49 U.S. Code § 31144, is to "determine whether an owner or operator is fit to operate safely commercial motor vehicles...", and to, "make such ***final*** safety fitness determinations readily available to the public". [emphasis added]

The FMCSA claims, "The CSA 2010 will ultimately provide FMCSA a new modern-operational model that will greatly enhance the Agency's efficiency at gathering and properly evaluating a greater proportion of the regulated population." However, only 11 percent of registered carriers had any scores in the CSA Safety Management System as of August 2011,[37] and of those with scores at least one significant study found, "...no meaningful statistical relationship between actual accident frequency and BASIC scores for Unsafe Driving, Fatigued Driving or Driver Fitness."[38]

Congress should focus on clarifying for the FMCSA exactly what their duties and priorities should be. At the current pace the FMCSA will have spent over 120 million dollars on CSA 2010 by the end of budget year 2012, and at best they have created a data recording system that has questionable value for predicting carrier safety for less than twenty percent of the 750,000 registered motor carriers. They still have no system that accomplishes the rating of all carriers as either; Satisfactory, Conditional, or Unsatisfactory. However, because of some confused judicial understanding of exactly what the SafeStat and SMS measurement systems can provide, the FMCSA's continued publication of SMS BASICs measurements imply to the public, and to some courts, that such data is valid for

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[34] FMCSA data base response to Freedom of Information Act inquiry, December 23, 2011.
[35] See. Note 22
[36] United States Government Accountability Office; Susan Fleming Director, Physical Infrastructure Issues; Report to Congress, February 25, 2011; GAO-11-416R
[37] *Evaluation of the CSA 2010 Operational Model Test, supra*
[38] *Wells Fargo, supra.*

evaluating a clear determination of carrier safety. It simply is not.

Congress must recognize FMCSA's clear failure to provide final and timely Safety Ratings on all registered motor carriers, and that within the context of this failure they have caused courts and the shipping public to be confused and burdened as to a reasonable and fair process for determining the safety worthiness of authorized motor carriers. As a first step in correcting this failure they should require FMCSA to remove from public view the developmental data (BASICs) now being displayed within the SMS. By FMCSA's own admission, its visibility and decisions made there from may have unintended consequences. Removing this data from public view will also relieve brokers and the shipping public from the mistaken judicial inference that such data is a reliable source for a final Safety Rating. Finally, and most import, requiring the FMCSA to remove this incomplete "intervention" data disabuses the notion that brokers and other shippers should have a duty to refer to it as a part of their diligent inquiry and duty of reasonable care.

Once such data is removed from public view, FMCSA may continue to develop it to a point of reliability and perhaps increased efficiency in performing their duty to provide final safety determinations and safety ratings on all registered carriers. In the interim, Congress, the transportation industry, shipping public and courts should not get confused by the FMCSA's apparent effort to rationalize and obfuscate their failure to fulfill their statutory and regulatory duty to provide to the public, "... **final** safety fitness determinations"[39] [emphasis added]. They simply have not done so in their entire existence.

B. Future Jurisprudence Must Provide a Duty of Reasonable Care for Brokers That Corrects the Imputed Duty to Refer to an Invalid Data Source

As has been demonstrated, the *Schramm* court required brokers to refer to a system of carrier safety evaluation (SafeStat) that was full of error, invalid and unreliable on the day their decision was announced. The successor to SafeStat, SMS, is at best a work in progress and is also invalid and unreliable as a definitive Safety Rating on motor carriers. It is clearly disclaimed as such by its originator, FMCSA.[40] Future litigators, and courts who hear such cases, must develop a remedial standard of due care for brokers that eliminates the Hobson's choice of being required to refer to the SMS measurement system for a definitive Safety Rating. For the vast majority of registered carriers it simply is not there. If it is there it is of questionable relevance due to issues of timeliness, errors in reporting and ratios computed that are imbalanced with greater weight to larger carriers.

So much more is known (than at the time of the *Schramm* decision) about the likely unreliability of SMS data that courts should be more inclined to exclude it as irrelevant, lacking in probative value, confusing and untrustworthy. The Federal Rules of Evidence and the corollary state rules, have many provisions that should be considered in motions *in limine* that fully develop the questionable relevance, probative value, confusion factor and hearsay nature of many of the data categories within SMS.

- Fed.R.Evid. 401 says, "Relevant evidence" means evidence having any tendency to make the existence of any fact that is of consequence to the determination of the action more

[39] Title 49, U.S.Code § 31144 (3)
[40] FMCSA, *Safety Measurement System*, http://ai.fmcsa.dot.gov/SMS/

probable or less probable than it would be without the evidence.

- Fed.R.Evid. 403 provides that even relevant information may be excluded if its probative value is outweighed by a danger that the evidence could be confusing, misleading or a waste of the court's time.
- Fed.R.Evid. 803 (8) denies the admission of government reports or data compilations in civil actions if the sources of information or other circumstances indicate lack of trustworthiness.

Assume that a broker researches a carrier and finds proper authority, regulatory insurance in place and a safety rating other than Unsatisfactory. The broker concludes that the carrier is properly authorized by FMCSA, and the broker has no current knowledge of incompetence or unsafe operations by the carrier. The broker knows that the SMS data is incomplete and that it may contain BASICs data that is incomplete and outdated, with ratios that are skewed by large carrier presence, and that a reputable statistical study concluded "...we find no meaningful statistical relationship between actual accident frequency and BASIC scores for Unsafe Driving, Fatigued Driving or Driver Fitness".[41]

Is admission of the SMS data, or broker's failure to look at such data, fairly likely to make it more or less probable that the broker was negligent? Given the established unreliability of the former SafeStat information, and the current state of confusion regarding SMS measures, is there any context in which the SMS data should not be excluded under Rule 403? Given the FMCSA's acknowledgement that SMS data is not a safety rating, but rather for internal intervention purposes, along with their disclaimers and published acknowledgment that all carriers are authorized to operate on the nation's roadways, unless they have been given an Unsatisfactory safety rating, is it more or less likely that presentation of SMS data is both confusing and untrustworthy under Rule 803 (8)?

It is suggested that more courts should rule as the Middle District Court of Georgia did when requested to take judicial notice of safety ratings published on the former SafeStat, finding that such data was not reliable evidence routinely contemplated by the rules governing judicial notice.[42]

CONCLUSION

V. Conclusion: Returning to a Sensible Duty of Care for Brokers

It has been argued herein that brokers and third-party logistics companies were for many years under a reasonable standard of care in selecting carriers, before the *Schramm* decision erroneously required that they refer to a source (SafeStat) that was invalid and unreliable in order to meet their duty of diligent inquiry and reasonable care. Furthermore, for all the reasons stated herein, the successor to SafeStat, FMCSA's Safety Management System, is as untrustworthy, if not more so.

With the proven failure of the FMCSA to provide final safety determinations and safety ratings for the vast majority of registered motor carriers, there simply is no definitive source with which brokers can make a meaningful determination of carrier safety. They are left with only a semblance of such a source. They can do as they have done for many years and refer to the safety rating provided by the FMCSA, in those instances where it is available. If such a rating is not available, surely the broker

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[41] Wells Fargo, supra

[42] *See FCCI Ins. Group v. Rodgers Metal Craft, Inc.*, 2008 WL 4185997 (M.D. Ga. 2008)

cannot he negligent for failure to infer one from what has been shown to be unreliable information.

The FMCSA has clearly failed its statutory duty, which in turn means that the Department of Transportation has failed to provide to the public "final safety determinations" and "safety ratings" as mandated by 49 U.S. Code § 31144. Congress has failed to properly recognize the magnitude of this failure and require accountability from FMCSA. Within this context, the courts have failed by requiring of brokers and third-party logistics companies a responsibility that could not be fulfilled, no matter how long they might look as SMS BASICs data. It is time for the Congress, FMCSA and the courts to realize the nature and significance of this folly, and restore to brokers and third-party logistics companies, who are least culpable, a standard of care that is realistic and takes into consideration the magnitude of what has been wrought from the confusion on this issue.

Congress must ask the FMCSA for answers to the following: Can they provide to the public final determinations of safety on all registered carriers? If not, how do they intend to comply with their statutory duty to do so? In asking these question and listening to FMCSA's response, Congress should not be distracted by FMCSA's rhetoric about "intervention"...it is not the same as providing safety ratings. If developmental data such as BASICs is a worthy element of ultimately getting to the ability to provide safety ratings, then let it be recognized as such and not as a rationalization for their failure to perform their primary duty. It follows that brokers should not be assigned this duty with the intractable information now admitted by FMCSA to be less than reliable for such a purpose.[43]

The courts who in the future consider the duty of brokers to use reasonable care in the selection of carriers should do so with recognition of the errors of the past. Such judicial reformation might start with a more careful analysis of the real role of brokers in the facilitation of providing carriers for loads and loads for carriers. It must also take into consideration that some of the prior decisions that have imposed impossible standards upon brokers have perhaps been motivated by subjective reasoning. Courts who reconsider the duty of brokers, in light of the mistakes of the Schramm decision, might consider the reasoning of Judge Smith of the Georgia Court of Appeals,

> ...we are troubled by the result in this case... We cannot, however, allow our sympathy for the plight of those injured by commercial trucks to lead us toward imposing strict liability on a party that does not possess the requisite degree of control over another's conduct. Resolution of this public policy issue lies with the legislative branch of our government, not with the judiciary.[44]

In the interim the courts can return to a more sensible notion that carrier safety is administered by FMCSA, and FMCSA has a statutory duty to provide a final safety determination and safety rating. Brokers and other third parties cannot fairly be charged with this duty. It is reasonable to suggest that this was the recognition of all courts who considered this issue for the fifty years preceding the *Schramm* decision.

* Readers should note that the formatting in this article is reserved for Law Review style articles. Regular research oriented articles should be formatted in conformance with the Journal's Submission Guidelines.

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[43] *See Note 24*

[44] *Clarendon Nat. Ins. Co. v. Johnson*, 666 .E.2d 567, (Ga. App., 2008)

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CROSS-CULTURAL VALIDATION OF THE FACTORIAL STRUCTURE OF A LOGISTICS STRATEGY MODEL: A THREE-COUNTRY STUDY

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ABSTRACT

In 2011, McGinnis, Kohn, and Kara reported the effects of overall logistics strategy (OLS) on logistics coordination effectiveness, customer service effectiveness, and organizational competitive responsiveness. This manuscript empirically compares the three dimensions of the Bowersox Daugherty typology to logistics strategies among U.S., Turkish, and Guatemalan companies. US, Turkish, and Guatemalan subjects (logistics managers) were chosen to test the underlying factor structure and measurement equivalences of the scales used. Using confirmatory factor analysis (CFA), findings indicate that the three dimensions of the Overall Logistics Strategy (OLS) - Process Strategy, Market Strategy, and Information Strategy - hold in all three country environments studied. However, structural equation modeling shows nonequivalent relationships between OLS and independent variables; logistics coordination effectiveness, customer service commitment, and organizational competitiveness for one of the three countries. We evaluate these findings in light of recent research into logistics strategy research on U.S. firms. Insights for those interested in comparative logistics strategies are provided.

INTRODUCTION

For over twenty years, a substantial amount of empirical research has investigated the potential of the Bowersox/Daugherty (1987) typology and validated it as a useful framework for studying logistics strategy in the United State and Canada. In comparison to cross-cultural research in other disciplines, such as management and marketing, a review published by Luo, Van Hoek, and Ross (2001) suggests that cross-cultural logistics is at best in its infancy stage. Considering the speed of globalization, a firm's ability to manage logistics in cross-country environments could become an important success factor. Although, globalization offers significant opportunities for many MNCs to shift their manufacturing and distribution around the world, and especially towards developing and emerging markets, global manufacturing strategies may not be effective if not supported by successful logistics strategies. Therefore, we strongly believe that cross-cultural logistics studies have significant potential to enrich our understanding of logistics systems and strategies applicable in different national environments. Such studies provide critical logistics knowledge which could have important international logistics management implications.

A recent study by McGinnis, Kohn, and Kara (2011) reported the role of overall logistics strategy (OLS) on logistics coordination

effectiveness, customer service effectiveness, and organizational competitive responsiveness. Using multi-year data collected in the US, their findings showed that overall logistic strategy as conceptualized by the Bowersox/Daugherty dimensions, had significant effect on firm competitiveness through the links of logistics coordination and customer service. However, even though the best way to measure overall logistic strategy (OLS) may be important to researchers and practitioners, whether or not the OLS should be assumed to be universal, is even a more important empirical question that deserves research attention. Therefore, our interest in this study is to explore whether the Bowersox/Daugherty typology is a useful instrument for examining logistics strategies in countries of different sizes, cultures, and economic systems.

The authors postulate that a multi-country study of U.S., Turkey, and Guatemala would furnish an intriguing study of how logistics systems are assessed in three nations through the lens of one common measurement instrument. Furthermore, such a study would provide a strong validation of the dimensionality and structural relations identified in the recent McGinnis, Kohn, and Kara (2011) study. We emphasize that the differences in each country's geographic size, population size, labor force make-up, infrastructure, and economic system provides an excellent platform for evaluating the validity of the research instrument, as well as providing insights into logistics strategies and outcomes in three heterogeneous countries.

This current research adopts the perspective that the Bowersox and Daugherty typology provides a strong conceptual basis consistent across countries with regards to salient dimensions of logistics strategy. These dimensions should be coordinated at many levels of the organization to achieve competitive responsiveness regardless of the country environment. Through this research we hope to uncover the applicability of logistics management strategy and understand the role logistics management strategy plays in maintaining and enhancing competitive advantage responsiveness in cross-country environments. Using a confirmatory factor analysis and a structural model, we assess the validity of three dimensions of Bowersox and Daugherty typology and their simultaneous relationship to logistics coordination, customer service effectiveness, and overall organizational competitive responsiveness in three different countries. The model adapted from McGinnis, Kohn, and Kara (2011) uses a second-order factor, called overall logistics strategy, to represent the three dimensions of the Bowersox and Daugherty typology and ultimately assesses its impact on firm competitiveness.

LITERATURE REVIEW

Managers are required to know the strategies that are used to sell their product lines, operate their business model and address the demand variables that are operating in their environments (Wanke and Zinn, 2004). Studying the approaches to a firm's decision-making process and typologies can assist managers with future decision challenges. While researchers have found ample data among large firms to confirm and support the Bowersox and Daugherty (1987) logistics management decision making typology (Clinton and Closs, 1997; McGinnis and Kohn, 1990, 1993, 1997 and 2002) there has been no substantive research focusing on the relevance the of Bowersox/Daughtery typology in different country environments. As such, there is a gap in the literature relating this typology and its applicability to different cultural environments of the developing and emerging markets.

Bowersox/Daugherty Typology and Research Variables

Bowersox and Daugherty (1987) completed a comprehensive study of logistics integration in 1987. In this research they identified three distinctly different logistics management strategy types that firms have used in their decision-making. These decision types are

process strategy, market strategy, and information strategy.

The three components that comprise the Bowersox/Daugherty typology were tested by McGinnis and Kohn (1993, 1997 and 2002). In these studies McGinnis and Kohn sampled subjects from large U.S. manufacturing firms. This empirical research found that process and market strategies were emphasized when logistics strategies were intense. It was also found that both strategies were present at moderate levels when firms used a balanced strategy approach, and that both strategies were present at low levels when firms used an unfocused strategy. All of their studies combined, indicated that the three dimensions (logistics process strategy, market strategy and information strategy) are important and have an effect on firm's successful management activities. They did, however, find that it is more likely that the three dimensions of the logistics strategy will be combined rather than used separately as Bowersox and Daughtery (1987) originally indicated.

In 1997 Clinton and Closs completed a major study testing the Bowersox and Daughterty typology. They sampled 818 U.S. and Canadian firms. The results of their study indicated that there was a clear overlap among the three strategies (information, market and process). They concluded that this is to be expected because logistics has to perform the same activities regardless of the overall logistics strategy. As such, with the typology demonstrating its importance in logistics management, it seemed only appropriate that more investigation should be done focusing on small firms since these business types constitute the largest employer of human resources and rely on logistics heavily to accomplish their goals. The research reported in this manuscript examined a sample of small firms to ascertain whether process, market, and information strategies can effectively describe logistics strategy in this wider context, and especially in the international environment.

The independent variables used in the research reported in this paper are based on the Bowersox/Daugherty (1987) typology discussed earlier and are summarized as follows:

- Process Strategy: Management of traditional logistics activities with a primary goal of controlling costs,
- Market Strategy: Management of selected traditional logistics activities across business units with the goal of reducing complexity faced by customers, and
- Information Strategy: A diverse group of traditional – and other activities – managed as a system with the goal of achieving inter-organizational coordination and collaboration through the channel.

The dependent variables used in this research were:

- Logistics Coordination Effectiveness: The extent that the organization coordinates logistics activities internally, as part of its overall strategic planning, and though-out its supply chain (customers, suppliers, and other channel members).
- Customer Service Commitment: The extent that customer services is emphasized through employee training, coordinated with other logistics activities, and used as a source of competitive edge.
- Company/Division Competitiveness: The extent that the organization quickly and effectively responds to, relative to competitors, supply chain (suppliers and customers) needs, competitor strategies, develops new products; and is considered a strong, moderate, or weak competitor in most of its markets.

All six variables are represented by scales that have been replicated, appear to fit the construct name, and have relevant levels of reliability, and are discussed in detail by McGinnis, Kohn, and Spillan (2010).

Recently, Chen *et al.* (2009) addressed the role of integration across the supply chain and its effectiveness on firm performance. Utilizing the process approach in supply chain, they argued that effective integration can be achieved through processes across the supply chain. While the importance of logistics strategy and process integration has been emphasized in previous studies, empirical analysis on the effect of logistics strategy and logistics integration is surprisingly rare. We attempt to address this gap in the literature by decomposing logistics integration into two components: logistics process integration (Chen *et al*, 2009) and logistics information integration. Logistics process integration is defined as "a set of continuous restructuring activities aimed at seamlessly linking relevant business processes and reducing redundant or unnecessary processes within and across firms. We define logistics information integration as the set of practices (such as electronic data interchange or integrated computer systems) associated with designing and development of information systems across firms.

Country Profiles

As shown in Table 1, the United Sates is much larger in area than both other countries (9,161,666 sq km/3,794,083 sq mi), with a varied climate, has a population of approximately 307.2 million, is 82% urban, a GDP of US$ 14,800 billion, 226,427 km/ 140,699 mi of railroads, and 4,209,835 km/ 2,615,942 mi of paved roads.

According to findings presented by Hofstede (2001), and shown as Table 2, the United States culture is moderate on Power Distance, low-moderate on Uncertainty Avoidance, high on Individualism, and high on masculinity.

TABLE 1
SELECTED COMPARISONS OF
THE UNITED STATES, GUATEMALA, AND TURKEY

Category	United States	Guatemala	Turkey
Area (sq km/sq miles)*	9,826,675/3,807,983	108,889/42,042 (Slightly smaller than Tennessee)	783,562/302,533 (Slightly larger than Texas)
Population*	307,212,123 est.	13,276,517 est.	78,785548 est.
Percentage of Population Urban*	82%	49%	70%
Make up of Labor Force*	Agriculture: 1.2% Agriculture: 50% Agricultural: 29.5%	Industry: 21.9% Industry: 15% Industry: 24.7%	Services: 76.9% Services: 35% Services: 45.8%
Gross Domestic Product*	$14.26 trillion est.	$69.21 billion est.	$960.5 billion est.
Climate*	Varied	Tropical	Temperate
Railroads (km/miles)*	226,427/140,699	332/206	8,699/5398
Paved Roads (km/miles)*	4,209,835/261,594	4,893/3,040	313,151/194,559
2008 Public-sector Corruption Index.	7.1: 22 of 178 countries.	3.2: 91 of 178 countries.	4.4: 56 of 178 countries.

*Source: *United States Central Intelligence Agency World Factbook* (www.cia.gov)
**Source: *Transparency International* (www.transparency.org). Index scores range between 9-10 = Very Clean to 0-.9 = Highly Corrupt.

Guatemala provides an excellent example of a country that contrasts with the United States. According to the *United States Central Intelligence Agency World Factbook* (www.cia.gov, 2010), Guatemala is slightly smaller than Tennessee (108,889 sq km/42,042 sq mi), tropical, has an estimated population of **14,361,666**, is 49% urban, a GDP of $69 billion, 332 km/200 mi of railroads, and 4,863 km/2,872 mi of paved roads. Culturally, Guatemala is relatively high on Power Distance, Uncertainty Avoidance, low on Individualism, and moderate on Masculinity.

As result of having the highest birth rate in Western Europe, Turkey has a very young population. It has significantly skilled and competitive labor, a massive domestic market, a unique geographical location, and a forceful private sector with close regional connections. The 2009 Census of Turkey counts its population at 72.5 million, with a growth rate of 1.45 percent per annum. Two-thirds (67 percent) of the population are in the group of those 15- to 64-years-old. (Turkish Statistical Institute, 2010). Turkey is slightly larger than Texas (783,562 sq km /302,533 sq mi). Turkey is also one of the countries in the world with a fast urbanization rate, at an average yearly annual rate of 1.9 percent between 2005 and 2010 (McGinley, 2009). There is a great movement into the cities from rural areas, which is producing the urban population to rapidly increase. Turkey has now reached almost one trillion dollars of GDP, and has 8,699 km/5398 mi of railroads, and 313,151 km/ 194,559 mi of paved roads. Turkey's culture is summarized as high on Power Distance, medium-high on Uncertainty Avoidance, moderate in Individualism, and moderate on Masculinity.

A careful review of the information presented in Tables 1 and 2 reveals three disparate environments for examining logistics strategy. The United States could be summarized as geographically large, with a population

TABLE 2
A COMPARISON OF AMERICAN, GUATEMALAN, AND TURKISH WORK PLACE CULTURES

Dimension Index/ Interpretation	United States	Guatemala	Turkey
Power Distance	40/38 (Moderate)	95/2-3 (High)	66/18-19 (High)
Uncertainty Avoidance	46/43 (Low-moderate)	101/3 (High)	85/16-17 (Medium-high)
Individualism/ Collectivism	91/1 (High)	6/53 (Low)	37/28 (Moderate)
Masculinity/ Femininity	62/15 (High)	37/43 (Moderate)	45/32-33 (Moderate)
Long-Term/ Short-Term Orientation	29/27 (Short-term oriented)	NA	NA

Source: Adapted from: Geert Hofstede (2001), *Culture's Consequences: Comparing Values, Behaviors, Institutions, and Organizations Across Nations, 2nd Edition*. Thousand Oaks, CA. Sage Publications. Appendix 5.

employed predominately in services, an average Gross Domestic Product of approximately $45,000 per capita, with a varied climate, and extensive transportation infrastructure appropriate for the country's size, and a moderately low level of public sector corruption. The United States culture is relatively egalitarian, more likely to be risk taking, individualistic, and results oriented.

Guatemala is small geographically, with a population employed predominately in agriculture, an average Gross Domestic Product of approximately $5,200 per capita, with a tropical climate, a modest transportation infrastructure, and an above average level of public sector corruption. Its culture is relatively hierarchical, more likely to avoid risk, collectivistic, and more likely to balance relationships and results. Turkey is geographically moderate in size with a population predominately working in industry and services, an average Gross Domestic Product per capita of approximately $12,000, a temperate climate, a well-developed transportation infrastructure, and an average level of public sector corruption. Turkey's culture is relatively hierarchical, between the United States and Guatemala on Risk Avoidance and on Individualism/Collectivism, and balanced on relationships and results.

As seen from Tables 1 and 2, as well as the summaries presented in the previous paragraphs, the results of an assessment of orientations toward logistics strategy in these three cultures should not be taken as a foregone conclusion. An ethnocentric perspective of a United States practitioner or academic might be "logistics strategy (and supply chain management) will be the same, or differ little, regardless of the economic/cultural situation." However, a polycentric perspective might argue that "Logistics strategy (and supply chain management) will be unique to each economic/ cultural situation, and logistics strategy will differ according to the economic/cultural characteristics of the situation." Finally, a geocentric perspective might argue that "The fundamentals of logistics strategy (and supply chain management) are similar and will be tailored to the needs of the economic/cultural situation."

STUDY METHODOLOGY

The following sections examine Measures, and Data Collection.

Measures and Questionnaire Development

To conceptualize the factors of our research model, we used scales adapted from McGinnis, Kohn, and Spillan (2010) study. The questionnaire was divided into three parts. In the first part, the overall logistics strategy of the companies were measured by three dimensions; *process strategy, market strategy and information*. Respondents were requested to determine their level of agreement with three statements for process, market and information strategies for their company /division on a five point -type scale (1 = definitely agree, 5=definitely disagree). In the second part of the questionnaire questions were asked in order to measure the relationships among logistics strategy constructs that are hypothesized to contribute logistics coordination effectiveness measured by three statements. Similar Likert scale measures (1 = definitely agree, 5=definitely disagree) in the first section of the questionnaire were used in the second section as well. In the third part of the questionnaire, we included statements to measure customer service commitment and company division competitiveness using the same Likert Scale as previously used in the first and second part of questionnaire.

Bilingual associates translated the designed questionnaire into both Turkish and Spanish. To ensure the quality of the translation, we used back translations to check for any discrepancies and translation errors in both countries. The questionnaires were pre-tested with a small group of participants in both Turkey and Guatemala before the questionnaire's administration. In both countries the results

TABLE 3
INDEPENDENT AND DEPENDENT VARIABLES[1]

	Scale items	Average Cronbach Alphas		
		USA	Guatemala	Turkey
INDEPENDENT VARIABLES*	**Scale 1: Process Strategy (PROCSTR)** 1.1. In my company/division, management emphasizes achieving maximum efficiency from purchasing, manufacturing, and distribution. 1.2. A primary objective of logistics in my company/division is to gain control over activities that result in purchasing, manufacturing, and distribution costs. 1.3. In my company/division, logistics facilitates the implementation of cost and inventory reducing concepts such as Focused Manufacturing and Just-in-Time Materials Procurement	.651	.524	.856
	Scale 2: Market Strategy (MKTGSTR) 2.1. In my company/division, management emphasizes achieving coordinated physical distribution to customers served by several business units. 2.2. A primary objective of logistics in my company/division is to reduce the complexity our customers face in doing business with us. 2.3. In my company/division, logistics facilitates the coordination of several business units in order to provide competitive customer service.	.741	.624	.894
	Scale 3: Information Strategy (INFOSTR) 3.1. In my company/division, management emphasizes coordination and control of channel members (distributors, wholesalers, dealers, retailers) activities. 3.2. A primary objective of logistics in my company/division is to manage information flows and inventory levels throughout the channel of distribution. 3.3. In my company/division, logistics facilitates the management of information flows among channel members (distributors, wholesalers, dealers, retailers).	.629	.739	.903
DEPENDENT VARIABLES*	**Logistics Coordination Effectiveness (LCE)** 4.1. The need for closer coordination with suppliers, vendors, and other channel members has fostered better working relationships among departments within my company. 4.2. In my company logistics planning is well coordinated with the overall strategic planning process. 4.3. In my company/division logistics activities are coordinated effectively with customers, suppliers, and other channel members.	.609	.733	.818
	Customer Service Coordination (CSC) 5.1. Achieving increased levels of customer service has resulted in increased emphasis on employee development and training. 5.2. The customer service program in my company/division is effectively coordinated with other logistics activities. 5.3. The customer service program in my company/division gives us a competitive edge relative to our competition.	.695	.634	.830
	Company/Division Competitive Responsiveness (COMP) 6.1. My company/division responds quickly and effectively to changing customer or supplier needs compared to our competitors. 6.2. My company/division responds quickly and effectively to changing competitor strategies compared to our competitors. 6.3. My company/division develops and markets new products quickly and effectively compared to our competitors. 6.4. In most of its markets my company/division is a very strong competitor.	.733	.532	.907

*Scales: 1 = Strongly Agree, 2 = Agree, 3 = Neither Agree nor Disagree, 4 = Disagree, 5 = Strongly Disagree.

were satisfactory with respect to the meaningfulness and the applicability of the questions in those country environments. The three independent and three dependent variables used in this research are presented in Table 3. Included in Table 3 are the items for each variable, and the scale reliabilities in each of the three countries (United States, Guatemala, and Turkey). Previous research (Kohn and McGinnis, 1997b) has concluded that the six variables are valid when studying logistics strategy using logistics managers in manufacturing firms for subjects.

Data Collection

Data for the research was collected using the developed questionnaire containing the above explained measures. The data for the U.S. was collected in manufacturing firms who were members of the Council of Supply Chain Management Professionals (CSCMP). Respondents from manufacturing companies were titled managers or higher in logistics, distribution, or supply chain management and were sampled via mail questionnaires with a pre-notification letter, the questionnaire with a cover letter, and a follow-up letter.

Data for Turkey was collected using a self-administered questionnaire that was distributed to 500 SMEs (Small-Medium enterprises) operating in the manufacturing sector within the city of Istanbul. This sample was selected randomly from the database of the Turkish Small Business Administration (KOSGEB). As of 2008, the KOSGEB database included a total of 12,270 SMEs in Istanbul. This accounts for nearly 28% of all SMEs registered throughout Turkey.

Requests were made for the survey to be done by a senior officer/executive in charge of logistics, distribution and supply chain management. The responses indicated that a majority of the respondents completing the questionnaire were in fact high level members of logistics departments. Of the 500 surveys posted, a total of 232 questionnaires were returned after one follow-up. 18 questionnaires were excluded due to missing values. The overall response rate was 43% (216/500), which was judged acceptable for subsequent analysis. An evaluation of the yearly sales volume, number of employees and sub-industry variation showed no significant differences between the responding and non-responding managers. Thus, the surveys satisfactorily characterized the total sample group of manufacturers.

In Guatemala researchers worked through the Ministry of Economics as a means of collecting data. Ministry of Economics staff was trained by the researchers on what the survey contents were, how to complete the survey and how to respond to questions from the respondents. In order to collect data The Ministry of Economics staff conducted face-to-face interviews with logistics, distribution and supply chain managers from midsize and large companies located in nine major regional centers in Guatemala. From these interviews staff were able to collect a total of one hundred and eighty (180) completed, usable surveys. The selected firms came from a large geographic area, with interviews taking place in several different areas including Guatemala City, Escuintla, Villa Nueva, Quetzaltenango, Cobán, Salamá, Chiquimula, Sacatepéquez and Petén. A total of 174 questionnaires were retrieved, but, only 156 usable questionnaires were attained due to incompleteness and other survey operations problems.

ANALYSIS AND RESULTS

The first step was to check the construct reliabilities for all three countries. Table 3 discussed earlier also shows comparative average construct reliabilities. Although some of the reliability scores were below the suggested levels in the literature, in general we can make a case that these scores are satisfactory for testing and validating the structure reported in McGinnis, Kohn, and Kara (2011). In addition, as coefficient values are relatively receptive to the number of items in the constructs, particularly when constructs have fewer than ten

items (as in the case of the research model), it is common to find quite low coefficient alpha around 0.50 (Pallant, 2007).

With the intention of evaluate whether the correlations among variables are suitable for factor analysis, we examined the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO-MSA) (Kaiser, 1970). Table 4 shows the results for KMO tests for sampling adequacy and Bartlett's test for sphericity for the 3 data sets of the US, Guatemala, and Turkey as well as the mean scores for the constructs in all three countries. The value of KMO-MSA was 0.832 for the US sample, .900 for Guatemalan sample and 0.663 for the Turkish sample indicating the data were appropriate for factor analysis. All KMO results were above .50 which is the minimum cut off for factor analysis. Additionally all levels of significance for Bartlett's test for sphericity were less than .005. KMO results along with the Bartlett results indicate the data is suitable for factor analysis.

Confirmatory Factor Analysis

To confirm the underlying factor structure, the authors conducted CFA on all datasets using AMOS. We assessed the goodness of the fit of the models using various fit indices testified to in previous studies, including the ÷ 2 statistic, normed fit index (NFI), non-normed fit index, (NNFI), comparative fit index (CFI) goodness of fit index (GFI); Standardized Root Mean, Square Residual (SRMR); and Root Mean Square Error

TABLE 4
AVERAGE VALUES OF INDEPENDENT AND DEPENDENT VARIABLES: USA, GUATEMALAN, AND TURKISH MANUFACTURING FIRMS

Variables	USA Data Average 1990-2008*	Guatemala Data Average, 2010	Turkish Data Average, 2010
Independent Variables			
1. PROCSTR**	2.332	2.245	2.071
2. MKTGSTR**	2.541	2.057	2.394
3. INFOSTR***	2.769	2.107	2.398
Dependent Variables			
1. LCE**	2.580	2.098	2.056
2. CSC**	2.5205	2.166	2.461
3. COMP**	2.3969	2.1090	2.6157
KMO Measure of Sampling Adequacy	0.832	0.900	0.663
Bartlett's Test of Sphericity	0.000	0.000	0.000

*Adapted from Adapted from: McGinnis, Michael A., Jonathan W. Kohn, and John E. Spillan (2010), "A Longitudinal Study of Logistics Strategy: 1990-2008," *Journal of Business Logistics*, Vol. 31, No. 1, pp. 217-235. **Scales: 1 = Strongly Agree, 2 = Agree, 3 = Neither Agree nor Disagree, 4 = Disagree, 5 = Strongly Disagree. *** Significant differences among three countries

of Approximation (RMSEA). The two-step approach suggested by Anderson and Gerbing (1988) was used to first examine the measurement model and then the structural model. In the measurement model, the relationship between the nine logistics strategic orientations and the three first order factors were examined to understand how well the relationships fit the data. In the structural model, we examined the relationship between the three first order factors (PROCSTR, MKTGSTR, and INFSTR). The findings supported the underlying factor structure of the 19 items with correlated factors.

The results of the estimation of the first order factor model revealed very strong results for all datasets used as indicated by several different measures (1). As suggested by McGinnis, Kohn, and Kara (2011), we allowed two of the error terms to be correlated. The figures of GFI and CFI, were all larger than or equal for all three countries (2).

The normalized chi-square (chi-square/degrees of freedom) of the CFA model was smaller than the recommended value of 3.0, the RMR was smaller than 0.05, and the RMSEA were smaller than or very close to 0.08 (3). Although the X^2 value for two of the datasets were significant, due to the sensitivity of this measure, it was not considered a major concern since the other fit indices showed strong model fit. Accordingly, the results in Figure 1 showed that all loadings in the model were significant, leading us to conclude that the relationships between the items and latent factors were confirmed by the three datasets obtained from different countries.

The last step in the process to confirm the underlying structure of the model was to evaluate the relationship between the three first order factors and a second order factor named "overall logistics strategy." The purpose here is to understand how the three factors contributed to an overall construct. The results of the second order confirmatory factor analyses for all three datasets showed very good fit indices (4).

Structural Models

The structural model was used to test the hypotheses of all six factors tested in the measurement model. The hypothesized structural models for three datasets are shown in Figure 2. Inspection of Figure 2 revealed that the all linkages were significant and the directions of

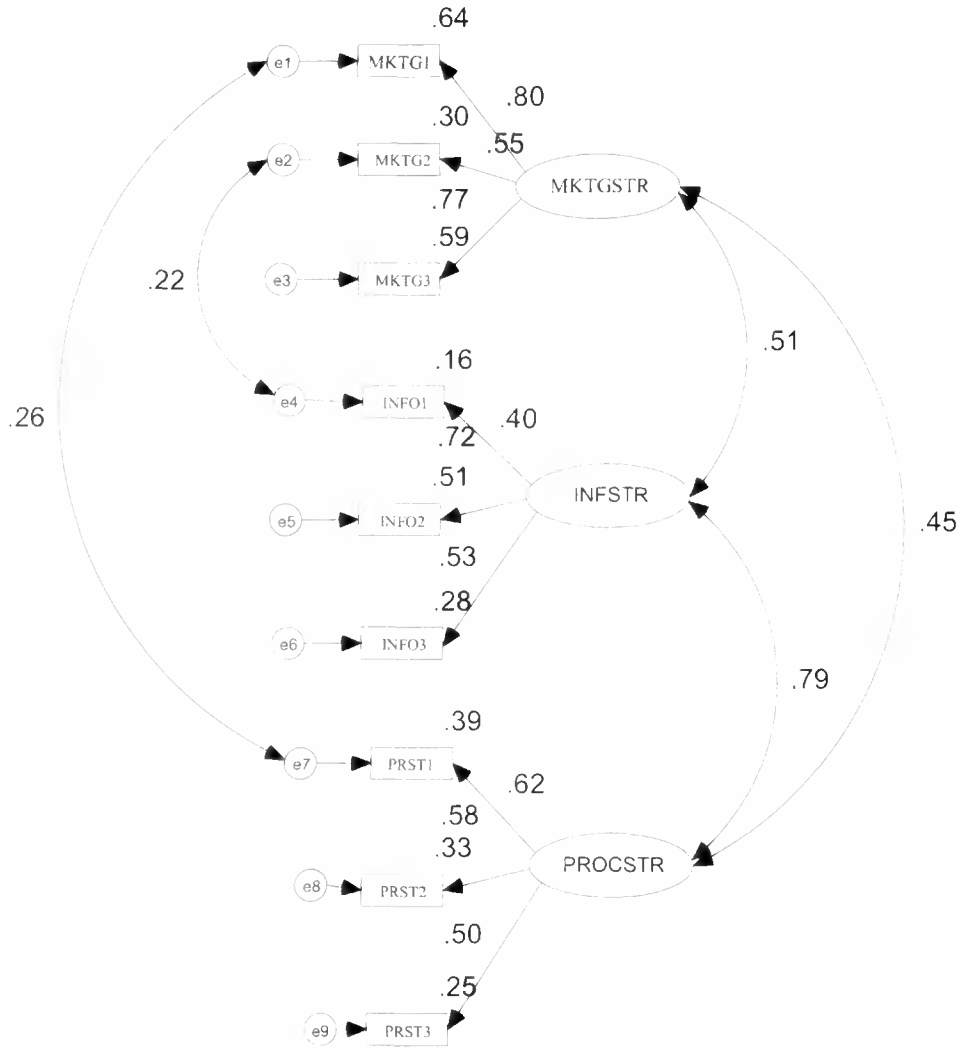
(χ^2_{USA}= 31.058, $\chi^2_{GUATEMALA}$ =48.65, and χ^2_{TURKEY}= 38.40) (1)

GFI_{USA}=0.962; CFI_{USA}=0.970; $GFI_{GUATEMALA}$= 0.940; $CFI_{GUATEMALA}$=0.941; GFI_{TURKEY}=0.962; CFI_{TURKEY}=0.988) (2)

($RMSEA_{USA}$=0.049; $RMSEA_{GUATEMALA}$=0.082 and $RMSEA_{TURKEY}$=0.059) (3)

(χ2 USA= 31.058; GFI USA=0.962; CFI USA=0.970; RMSEA USA=0.049; χ2 GUATEMALA =27.89; GFI GUATEMALA=0.940; CFI GUATEMALA=0.941; RMSEA GUATEMALA=0.082; χ2 TURKEY= 36.37; GFI TURKEY=0.962; CFI TURKEY=0.988; RMSEA TURKEY=0.059) (4)

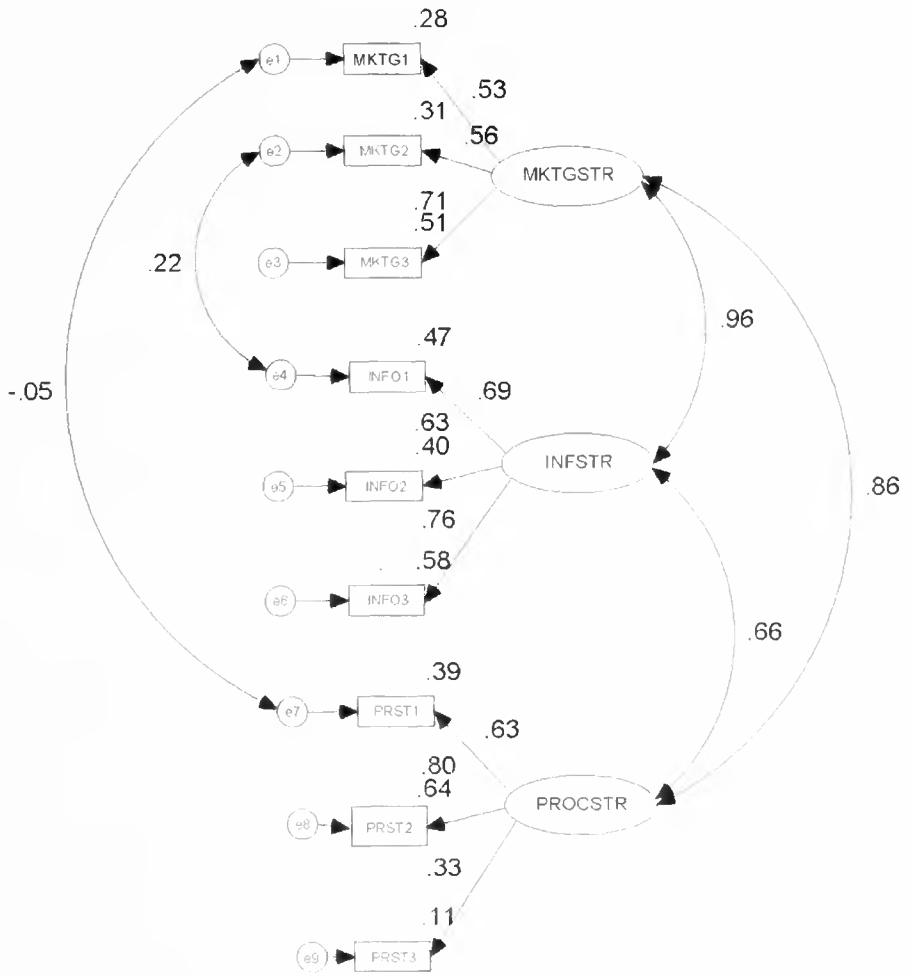
FIGURE 1
FIRST ORDER CONFIRMATORY FACTOR ANALYSIS OF OVERALL LOGISTICS STRATEGY
A. USA DATA



Chisquare=31.058
p=.095
CFI=.970
GFI=.962
RMSEA=.049

FIGURE 1
B. GUATEMALA DATA

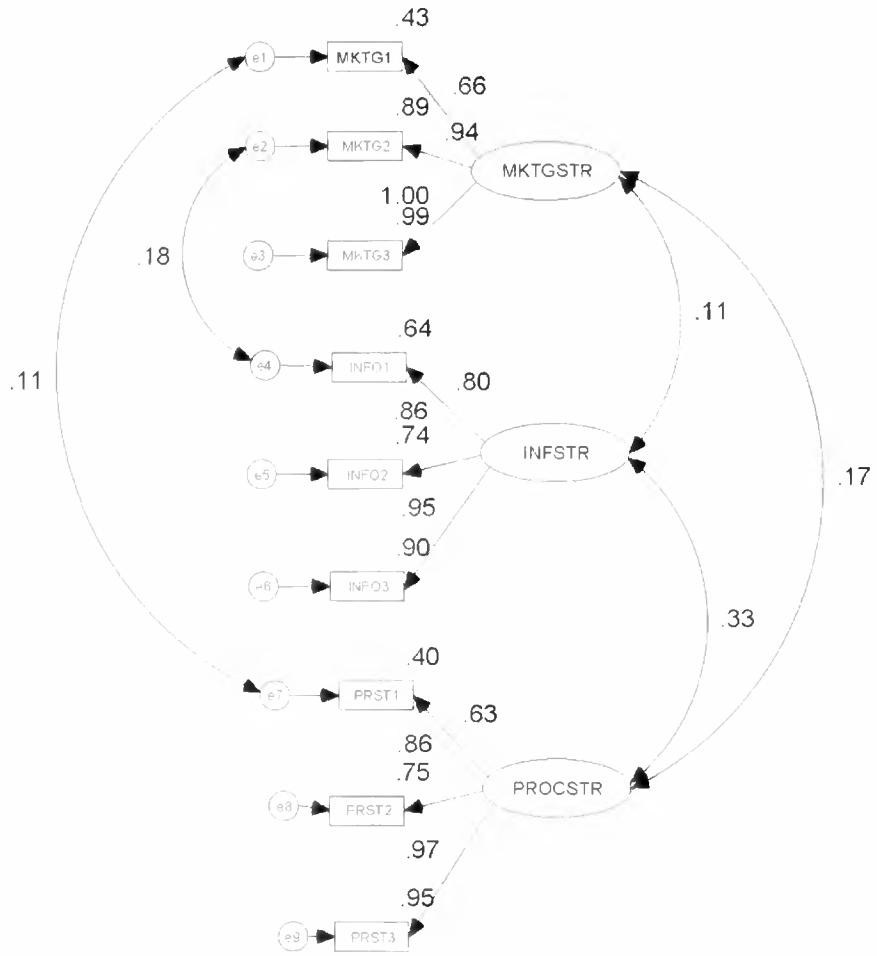
First Order Confirmatory Factor Analysis for Overall Logistics Strategy Guatemala Data



Chisquare=48.651
p=.001
CFI=.941
GFI=.944
RMSEA=.082

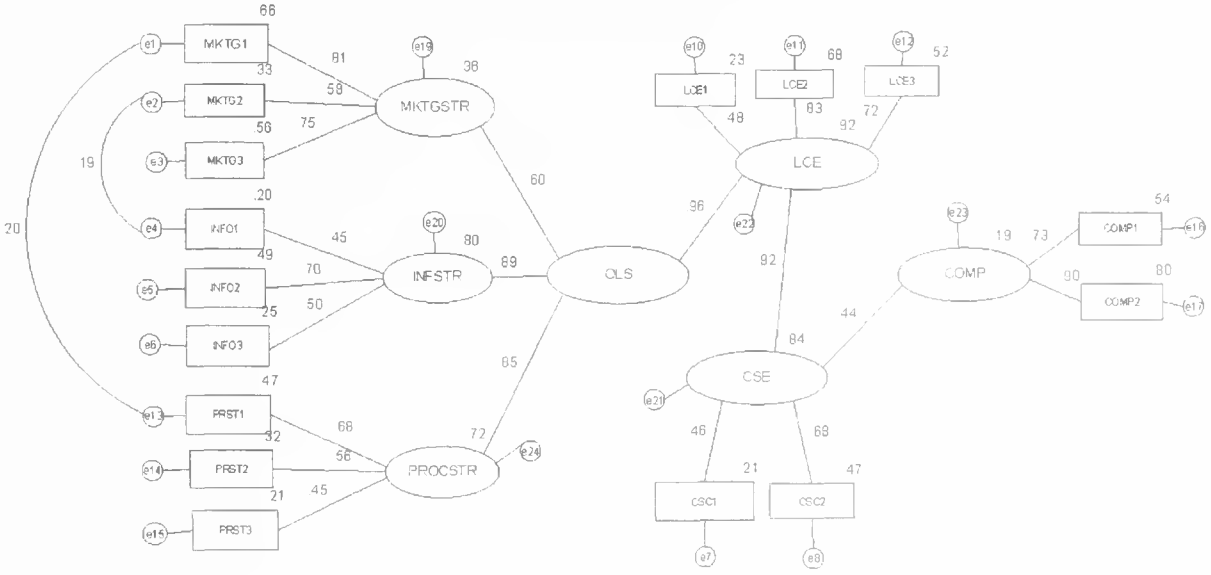
FIGURE 1
C. TURKISH DATA

First Order Confirmatory Factor Analysis for Overall Logistics Strategy Turkish Data



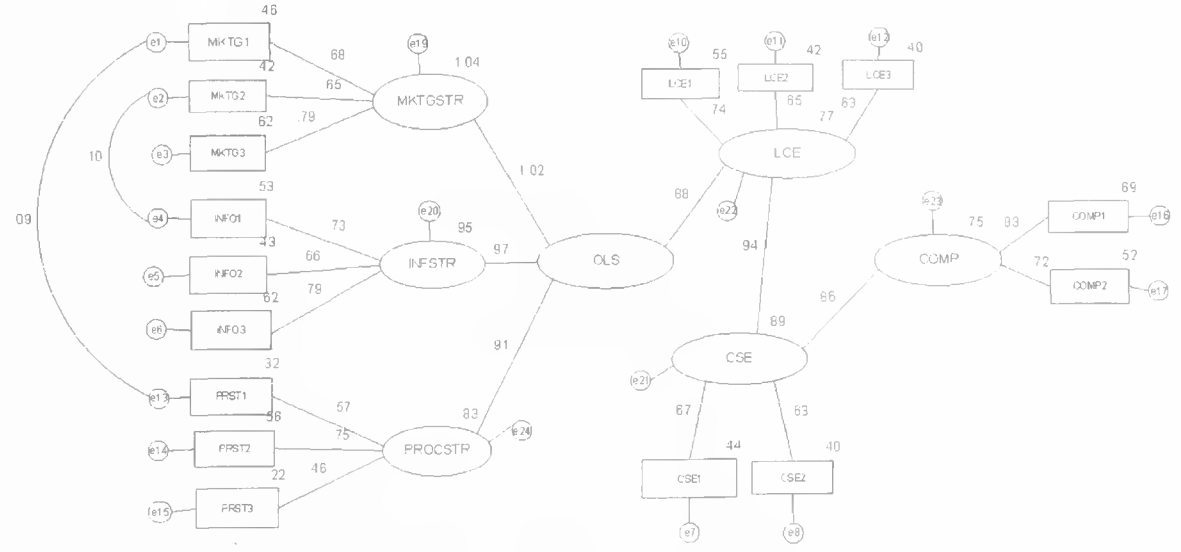
Chisquare=38.402
p=.017
CFI=.988
GFI=.962
RMSEA=.059

FIGURE 2
SEM FOR OVERALL LOGISTICS STRATEGY AND COMPETITIVENESS
A. USA DATA



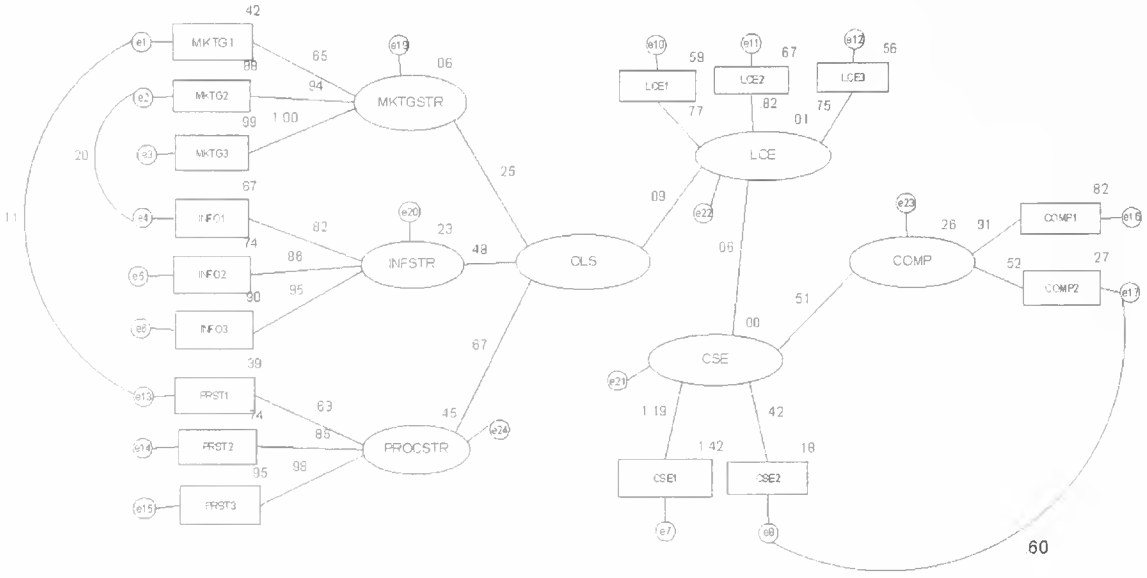
Chisquare=125.971, p-value=.022, GFI=.916, CFI=.960, RMSEA=.043

FIGURE 2
B. GUATEMALA DATA



Chisquare=192.600, p-value=.000, GFI=.867, CFI=.910, RMSEA=.081

FIGURE 2
C. TURKISH DATA



Chisquare=170.718, p-value=.000, GFI=.912, CFI=.962, RMSEA=.061

relationships were as hypothesized for the US and Guatemala datasets. Although the model fit is considered acceptable, only one of the hypothesized links for Turkish data was significant. In other words, it seems like OLS and LCE did not have any significant influence on CSC. Only CSC had significant influence on competitiveness of Turkish companies.

Overall, the US and Guatemala datasets supported the hypothesized relationship directions and strength of the hypothesized relationships, while Turkish dataset did not provide the expected support. While this may be due to some other factors not examined in the study, one could speculate that there might be fundamental differences among these constructs in the Turkish market environment. However, the authors conclude that the agreement on the consistency of direction of the relationships in factor structures in all three datasets, and support for hypothesized structural relationships in two out of three datasets, provides encouragement regarding the relationship of logistics strategy and Organization Competitive Responsiveness in international environments.

DISCUSSION AND IMPLICATIONS OF FINDINGS

The results of this study provide helpful insights to logistics/supply chain management practitioners regarding effective management of logistics strategy and contributions to organizational competitiveness. First, overall logistics strategy (OLS) does not seem to differ among disparate cultures. As discussed earlier, the three components of OLS (process, market, and information) appear to be consistent across the three cultures examined. However, agreement regarding the lack of significance between OLS and logistics coordination effectiveness (LCE), and the lack of significance between LCE and customer service coordination (CSC) in Turkey provides some pause regarding the premise that logistics/supply chain strategy necessarily leads to organizational

competitiveness. In the Turkish data the lack of significance between OLS and LCE do not indicate a lack of significance between CSC and organizational competitive responsiveness (COMP). This indicates that customer services contributes to organizational competitive responsiveness regardless of whether there is a close relationship between the overall logistics strategy (OLS) and the commitment to customer service (CSC). These findings suggest that, at least in the Turkish data, that the goals of customer service coordination may be achieved across the organization, as suggested by Chen *et al.*, 2009, rather than as a result of a focus by one component of overall strategy, such as OLS. While an organizational focus on customer service is the goal of logistics and supply chain management, it may be possible that an organization may be focused on customer service independent of OLS. Stated another way, an organization (or culture) with a commitment to customer service may not require the logistics strategy to facilitate that commitment. Further research into logistics strategy in other cultures may provide further insight into the strength of logistics/supply management's role in customer service and organizational competitive responsiveness.

Our findings show that given the Bowersox/ Daugherty dimensions of logistics strategy are invariant across the cultures/countries studied and that the measures of logistics strategy assessed by three dimensions hold in all three countries. These results suggest that the assumed links between logistics strategy and organizational competitiveness did not hold in all cultures. In other words, even if overall logistics strategy may be comprised of process, market, and information dimensions, its impact on overall organizational competiveness may vary across the nations.

In the case of the Turkish model, although not significant, the relationships between the constructs were in the hypothesized direction with CSC showing the strongest effect on the organizational competiveness. At first glance, one might question this finding and argue against the validity of the structural model. However, the Turkish economy is going through a tremendous liberalization and is considered a major emerging market. Therefore, it is the high volatility market in terms of structural realignments, and this may result in an emphasis on customer service and competitive responsiveness being integral to strategy as the Turkish economy emerges into an already competitive global economy. Second, because many Turkish logistics activities are still performed using traditional inefficient systems, an emphasis on customer service and competitive responsive may be resulting in logistics management in Turkish organizations being bypassed by organizational priorities and strategies. This might have led to a significant variation among the participants in terms of their understanding and expectations of logistics strategy. Finally, it is possible that the current structural model might not have captured the effects of logistics strategy on overall competitiveness due to the rapid changes taking place in the economy, Turkish business strategies, and lags in the role of logistics in Turkey.

CONCLUSIONS

The purpose of this study was to explore whether the Bowersox/Daugherty typology is a useful instrument for examining logistics strategies in countries of different sizes, cultures, and economic systems. We mentioned at the outset of this study that globalization has altered the management activities and practices of many world wide companies. With supply chain management at the center of business activity, it is imperative that managers find and use new ideas that will help them become more competitive in highly competitive markets. Finding new insights into how they can manage their manufacturing and supply chains is essential for goal attainment, profitability and sustainability.

Our findings indicate that there are some similarities and some differences in how managers conceive the issues of logistics and how they process them and execute them in their daily practice. This is not unusual nor is it a negative out come. We would expect that in different cultures managers would see some processes, some strategies and information exchanges differently. It is important to note that the fact that there is consistency in direction and relationship of constructs means that the Bowersox/Daugherty typology is a useful instrument for examining logistics strategies in different countries and our confirmatory factor analysis results validate the dimensionality of the model. We tested previous hypotheses regarding the effect of logistics strategy and logistics practices on firm's competitiveness in the context of cross sectional business firms. Therefore we can say that managers in different countries and cultures have some of the same ideas about the meaning of the logistics concepts and how they need to be implemented. This is very important to managers for a couple of reasons: (a) when considering out sourcing or expanding to a foreign land i.e. Guatemala or Turkey, managers can have a better understanding of how these countries will react to the logistical strategy, process and information issues that are present in their companies and countries, and (b) when exporting or importing goods, companies can have more insight into the relationships that are present in the three concepts studied in this research. Our findings suggest that logistics and supply chain management appear to be geocentric, where, as stated earlier, the fundamentals of logistics strategy (and supply chain management), while fundamentally similar, will be tailored to the economic/cultural situation. While overall logistics strategy may be a driving force for competitive responsiveness in many cultures, it appears that competitive responsiveness in some cultures will originate elsewhere. To what extent these statements holds will be the result of further research into logistics strategy in additional cultures.

SUGGESTIONS FOR FUTURE RESEARCH

Future research into logistics/supply chain management should seek opportunities to explore practices in other countries/cultures. Little is known of comparative logistics/supply chain management in the various countries of Asia and the subcontinent of India. Further, logistics and supply chain management practices, and their impact on customer service and organizational competitive responsiveness have not been systematically studied. Further research into logistics and supply chain management may benefit from expanding the understanding of logistics/supply chain management decision making by including antecedents and moderating factors (such as competition, market turbulence, and differences in business environment) into the design.

In addition to further study of logistics/supply chain management in other nations/cultures, additional insight could be gained by examining the relevance of the Bowersox/Daugherty typology to nonmanufacturing industries including retailing, healthcare, financial services, transportation firms, and food service. These industries may provide a different perspective on the process, market, and information strategy in different environments.

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LTL PRICING: LOOKING BACK TO THE FUTURE

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ABSTRACT

Numerous LTL carriers struggled during the recent recession as customers demanded lower prices. This study is designed to qualitatively evaluate the data gathered from three industry segments regarding LTL pricing. Researchers used semi-structured interviews to conduct an in-depth investigation with over two dozen industry experts who represented shippers, carriers, and 3PLs. Interview transcripts were analyzed using a grounded theory coding technique. Five major themes emerged from the interview transcripts. These themes are used to describe possible future adjustments to industry pricing structure.

INTRODUCTION

During the late 1970's, legislators and regulators began to reexamine the impact that regulation was having on the motor carrier industry. Many experts felt that the marketplace of the 1970's was far different from the marketplace of the 1930's which initially led to transportation regulation. By the late 1970's, policy and industry experts asserted that regulation was no longer necessary and that the costs of continued regulation dramatically outweighed any benefits that might be obtained from continuing to regulate the motor carrier marketplace (Harper, 1982; Pickett and Kletke, 1984; Pustay, 1985). Additionally, it was determined that some operating inefficiencies and anti-competitive pricing practices were taking place (Chow, 1980).

On July 1, 1980, the Motor Carrier Act of 1980 was enacted, exhibiting a shift in government policy toward a free marketplace, effectively ending forty-five years of federal regulation of the industry. Deregulation altered the landscape of the industry in many ways as carriers attempted to adjust to the new operating environment. One major challenge carriers faced was the pricing of their services. In a regulated environment, individual carriers were not responsible for establishing prices for specific services. Along with deregulation came the freedom and responsibility for carriers to establish their own price for a specific service. Pricing in a free market environment was critical to carrier survival, but it was also uncharted territory.

U.S. motor carriers traditionally referred to the National Motor Freight Classification (NMFC) system as the basis for classifying freight. This classification system, along with an extensive tariff system developed during the regulated era, were still being used as guides after deregulation to help carriers establish transportation rates. Over time, the "base rates" reflected in the legacy pricing systems began to portray a less accurate depiction of motor carrier pricing reality. As a result, carriers began to *discount* the base rates of the old system to more accurately reflect the actual price of a carrier's services.

Now more than 30 years removed from deregulation many feel the base rates, while still being used extensively by the U.S. motor carrier industry, have become almost meaningless. Experts point to the common practice of deeply discounting base rates as a primary indication of the gross inaccuracy of the base rates currently being used to price motor carrier transportation services. Many of these same individuals have also called for a complete motor carrier pricing system overhaul.

We examine the current state of LTL pricing and draw conclusions on future directions based on a series of expert interviews and a qualitative data analysis. The paper is structured as follows. First, relevant transportation pricing literature is reviewed. Second, we describe the methodology utilized in this research. Next, key findings are summarized and major themes emerging from the analysis are highlighted. We then comment on the future of LTL pricing and suggest options available to those pushing for change in industry pricing structure.

LITERATURE REVIEW

Despite the critical role of transportation, the pricing of transportation services has received little attention (Topaloglu and Powell, 2007; Toptal and Bingöl, 2011). Relatively few articles have focused on the pricing of LTL service (Özkaya et al., 2010). Ying and Keeler (1991) studied the effects of deregulation on motor carrier freight rates and found competitive pressures following deregulation had led to increased productivity and reduced rates subject to extensive discounting. Baker (1991) found that routine discounting, sometimes as high as 85%, had made base rates meaningless and that the only meaningful figure was the effective rate (base rate less discounts). Smith (1993) acknowledged the complexity of setting prices in an industry where the base rate is constantly changing and discounting is so important to a firm's competitive advantage. Carter, Ferrin, and Carter (1995) found evidence that purchase order anomalies were the result of LTL pricing strategies focused exclusively on highly competitive LTL shipments and that this tended to lead to overpricing the less common truckload shipments handled by the LTL carrier.

Richardson (1998) reported on the complexity of the LTL pricing system and the call by many industry leaders to move out of the quagmire of regulated thinking. The need for a change to be accepted across the board was highlighted by the problem of shippers cherry picking rates. Harrington (1998) provided shippers with a primer for understanding many of the factors of a carrier's rate structure and recommended that shippers take those factors into account in order to negotiate the best price for services. The active process of negotiating LTL prices was also described by other researchers (e.g., Vilain and Wolfrom, 2000; Caplice and Sheffi, 2003; Clair and Fox, 2004; L. D. Smith, Campbell, and Mundy, 2007).

More recent LTL studies have tried to examine potential alternate pricing methods. Lin, Lin, and Young (2009) developed a mathematical model to determine the optimal price for time-definite LTL freight services in Taiwan using data from one of the largest LTL carriers in Taiwan. Özkaya et al. (2010) used regression-based methodology to estimate LTL rates based on three months of data from 2005. Several articles have offered analytical models to describe motor carrier pricing (e.g., Figliozzi, Mahmassani, and Jaillet, 2007; Topaloglu and Powell, 2007; Zhou and Lee, 2009; Toptal and Bingöl, 2011).

This study follows up two, somewhat dated research reports that previously examined LTL motor carrier pricing practices. The first study titled "Pricing for the Nineties: An Examination of LTL Motor Carrier Pricing Practices and Suggestions for Improvement by Shipper Customers" was conducted in 1993 by the University of Tennessee's Center for Logistics Research. A subsequent study examining LTL motor carrier pricing was conducted in 2002 by Norbridge, Incorporated; a management consulting company headquartered in Deerfield, Illinois. The current study is designed to provide the industry with up to date insights into the current state and future directions of LTL motor carrier pricing.

METHODOLOGY

Qualitative methods are being used more frequently in contemporary supply chain management research (Mello and Flint, 2009).

Qualitative methods are quite useful when gaining understanding of the phenomenon of interest is a primary research goal, or the phenomenon is relatively unstudied as is the case with our investigation of LTL industry pricing practices (Halldorsson and Aastrup, 2003; Suddaby, 2006). We combine semi-structured interviewing and the constant comparison process of grounded theory data analysis, similar to the approach outlined by Randall, Defee and Brady (2010).

Sample and Unit of Analysis

The sample was developed from three distinct groupings of firms that participate in the LTL pricing process: LTL carriers, shippers (individual customers), and 3PLs (aggregators of multiple customers under a single freight contract). Approximately 30 companies were contacted and 25 companies agreed to participate. The sample provided good coverage from each of the three groups. Participating companies are listed in Table 1.

We used a judgmental sampling method (Fetterman, 1989) by seeking out the individual within each organization best equipped to address the topic of LTL pricing. Individual participants were identified within each organization by requesting an interview with one manager or executive responsible for making decisions associated with LTL pricing. In carrier organizations this was often a Vice President of Marketing, Pricing, or Revenue Management. In shipper and 3PL organizations the interviewee was typically a Director of Transportation or Procurement. In each case participants demonstrated intimate and exacting knowledge of LTL industry practices and specifically the pricing/rating process.

A total of 25 interviews were completed with an average duration of 28 minutes and a standard deviation of 12 minutes. All interviews were recorded and transcribed for later analysis. In all, the single-spaced transcripts totaled approximately 200 pages. The unit of analysis for this study were the discrete statements regarding LTL pricing (Sherif, Zmud, and Browne, 2006).

Analytical Process

Each transcribed interview was initially reviewed for quality prior to initiating qualitative analysis. Grounded theorists argue that sampling is complete when saturation of the identified categories (i.e., the point of diminishing returns) has taken place, which as explained by Charmaz (2006), supersedes sample size. Premkumar (2003) points out that despite the cost and time involved, the interactive aspect of telephone interviews makes

TABLE 1
PARTICIPATING COMPANIES BY GROUP

Carriers	3PLs	Shippers
AAA Cooper Transport	Cerasis	Central Steel and Wire
Averitt Express	CH Robinson	Deere & Company
Central Freight Lines	England Logistics	Mettler-Toledo
Estes Express	Menlo Worldwide Logistics	PACCAR Manufacturing
FedEx Services	TransPlace	Peerless Pump
New Penn Motor Express	Unyson Logistics	Pep Boys
Southeastern Freight Lines	USTC Live Logistics	Saint-Gobain Abrasives
UPS Freight	YRC Logistics	Toro Company
		Wix Filtration

them very effective in attaining reliable data. In this case the final 1-2 interviews in each category provided limited or no new information suggesting saturation had been achieved (Cho and Trent, 2006).

The constant comparison technique (Glaser and Strauss, 1967; Glaser, 1978; Charmaz, 2006) was used to code, memo, categorize, and recode the data. Coding is the method by which the data are fractured, analyzed, and grouped into categories and ultimately into themes (Scholten, 2009). MAXQDA, a commercially available software program, was used to streamline and organize analysis of the transcripts. This software uses data management techniques such as multi-color coding, memo creating, and code segment retrieval (Humble, 2009). Counts provided by the software represent the frequency for each of the themes and sub-categories (Sherif et al., 2006).

The first one-third of transcripts were divided among two of the researchers and each researcher independently coded their portion of the transcripts. Once this task was completed, the research team met to review and discuss the individual coding results. Common terminology was agreed upon in cases where it was discovered that slightly different codes had been used to identify similar concepts. The research team then completed coding the remaining transcripts, frequently discussing new codes and recoding as necessary.

Throughout this process, codes were assigned to categories based on similarity of intent. Ultimately these categories were assigned to higher-level categories which represent the major themes emerging from the interview data (Lincoln and Guba, 1985). This category assignment process was performed individually, but routinely evaluated, adjusted, and confirmed through frequent meetings among the research team.

The trustworthiness of the research was assessed using the technique described by Flint and colleagues (2002). Internal (e.g., confirmation of results by multiple research team members) and external (e.g., member checks conducted with a sub-set of interviewees and non-sample business professionals) constituents were utilized to assess the dimensions of credibility, transferability, dependability, confirmability, integrity, and fit (see Table 2). The member checking activity was conducted with three carrier representatives, three executives of an LTL industry rating agency, and through feedback from two presentations of preliminary results at two national LTL conferences. The feedback provided was extremely helpful in shaping the initial interpretive analysis and later in validating our conclusions.

SUMMARY OF FINDINGS

The interpretive analysis of interviews with carriers, shippers, and 3PLs resulted in five emergent themes. Each of these themes is outlined in this section. As Table 3 shows the themes developed cut across all industry participants. The categories listed in the table demonstrate a breadth of topics that coalesce to form each theme. In some cases the categories represent essentially opposite views (e.g., re-indexing is needed; re-indexing is not needed). This demonstrates one of the inherent issues in the industry summarized in the last theme – although there is wide support that change in needed, there is little agreement on the best approach for achieving that change. We offer testable propositions for each theme.

Theme 1: Base Rates Should be Re-Indexed

A base rate is simply the standard rate offered for a carrier to move a given shipment from an origin to a destination. For example, the base rate for a carrier to move a 750 lb. pallet of auto parts from Macon, GA to Orlando, FL may be $250. However, the rating basis used throughout the LTL industry has very little relation to current carrier operating costs and service options available through existing networks.

TABLE 2
EVALUATION OF TRUSTWORTHINESS

Criteria	Method used to address
Credibility Extent to which the results appear to be acceptable representations of the data	**Three research team members** provided input during data analysis and interpretation
Transferability Extent to which the findings from one study in one context will apply to other contexts	**Triangulation across methods** found common categories in content analysis and interviews
Dependability Extent to which the findings are unique to time and place; the stability or consistency of explanations	**Member checking** confirmed category theme development
Confirmability Extent to which interpretations are the result of the participants and the phenomenon as opposed to researcher biases	**Saturation** achieved within each of the three groups present in the sample
Integrity Extent to which interpretations are influenced by misinformation or evasions by participants	**Member checking** confirmed category theme development
Fit Extent to which findings fit with substantive area under investigation	**Member checking** interviewees were not provided an explanation of findings prior to interview

Notes: Trustworthiness definitions adapted from Flint et al. (2002).

Most rates used today were actually developed 20-30 years ago or longer, oftentimes during the regulated period, and have been only moderately adjusted over the years. The rates are frequently discounted 80% or more to establish the actual prices charged to shippers.

Concern that the rating basis is meaningless is widespread as the bulk of comments tended to support the need for re-indexing. Participant comments from each of the groups demonstrate this is a generally held belief.

- *"We know we're going to have to update [the base rates] shortly, because it's getting out of whack"* (Shipper).
- *"Is the base rate completely arbitrary? Yeah, it's ridiculous"* (3PL).
- *"If the discounts are ridiculous, they're only slightly less ridiculous than the base rates they're off of"* (Carrier).

This belief is not new to the industry. A study from 20 years ago (Baker, 1991), identified similar unease with the rating-pricing process. Thus, not much has changed in the industry in recent years. Although a number of participants suggested the market is ready for the re-indexing of base rates, many comments highlighted the complexity of making such a change.

- *"I don't think the marketplace is ready. I think it would take years to get there"* (3PL).

TABLE 3
SUMMARY OF THEME DEVELOPMENT

Theme	Category	Shipper	3PL	Carrier
Base rates should be re-indexed	Re-indexing is needed	X	X	
	Re-indexing is not needed	X		X
	Re-indexing will be difficult to accomplish		X	
	The market is ready for re-indexing	X	X	
	The market is not ready for re-indexing		X	X
Wide use of benchmark pricing	Used for base rates	X	X	X
	Industry standard	X	X	X
	Compare across carriers	X	X	X
	Used to set freight rates charged to customers	X	X	
Freight rates are based on classification rules	NMFC classification is entrenched		X	X
	NMFC classification is complex - confusing	X		
	NMFC classification is manipulated		X	
	NMFC classification is moving to FAK			X
	FAK simplifies freight rating	X	X	
	FAK provides deeper discounts	X		
Density / cube-based pricing	Future direction (near term)	X	X	
	Will add cost for shippers	X	X	X
	Will add cost for carriers		X	X
	Carriers have already created this rate structure		X	X
	Surprised requests have not occurred			X
Industry change leadership	Carriers should lead		X	X
	Shippers should lead		X	X
	"Neutral" party should lead (i.e., SMC[3])		X	X
	Shippers and carriers in concert		X	
	Shippers are the barrier to change			X

- *"I think the carriers are definitely ready for it. I don't think that the shippers are [ready]"* (3PL).

- *"It may be cost prohibitive given the ROI of most motor carriers today and how the industry is structured around it"* (Shipper).

- *"If the heavy discounting activity disappeared, obviously we wouldn't be able to negotiate better pricing"* (Shipper).

The last comment points out a basic fear shared by each of the groups. LTL service is viewed as a commodity by both carriers and shippers. Although service levels and damage vary across carriers, shippers are extremely price conscious in making the LTL freight purchase decision. If re-indexing were to occur on a piecemeal basis, many individual carriers believe they may be seen as not being price competitive, at least until customers became educated on how their revised rate-price structure compares to the established structure. Alternatively, if re-indexing were to be rolled out simultaneously by all carriers, the carriers

that perceive themselves as weaker believe they would be at a disadvantage. Quite simply the motivation to change base rates has not been great enough to overcome the perceived risk of making such a change.

The entrenched nature of the base rate-pricing structure and lack of movement toward establishing new base rates over the past 20 years suggests the industry is at an impasse on this issue. The interview comments and our review of other studies touching upon the topic lead us to believe the industry will not find a way to re-set base rates in the near future despite the broadly held belief this is desirable.

Theme 2: Benchmark Pricing

The concept of benchmarking to help manage a business by assessing your position relative to others in the marketplace is relatively common. Benchmark pricing tools – typically software containing base rates for all origin-destination combinations – are widely used by both buyers and sellers attempting to enhance their understanding of LTL motor carrier pricing practices. Several commercially available benchmarking tools are available to aid current and prospective customers faced with assessing LTL prices.

The use of benchmarking is valuable to many in the LTL market because of the unique pricing practices currently used in the industry. With many different sources available to establish a base LTL rate and many different discounts off of the various base rates, it is extremely difficult to accurately compare the actual price for a particular origin to destination combination. Use of a benchmarking process helps to standardize the pricing process.

Shippers frequently request that new LTL transportation bids be based off of a specified tariff or commercially available LTL base rate benchmark tool such as SMC3's CzarLite. This allows for some standardization of the pricing process, ultimately enhancing the ability of the shipper to effectively evaluate carrier responses to their request for proposal (RFP).

- *"Use of a benchmarking tool allows for an 'apples to apples' comparison when we are evaluating different bids from potential providers of LTL transportation services"* (Shipper).

- *"Some shippers accept quotes based on our internal tariff base rates while others require quotes based on a different rate base source like CzarLite. We know our costs of providing specific services so we can quote based off of any base rate requested"* (Carrier).

Many participants conceded that benchmarking is a valuable tool, especially in an industry with a unique pricing system. However, others indicated they use caution when examining and interpreting LTL pricing data obtained through a benchmarking process due to potentially significant limitations. For example, several interviewees indicated that any current LTL pricing benchmark must be viewed cautiously due to the complexity of current LTL pricing practices.

- *"There are a number of base rate sources that can be used to help benchmark LTL motor carrier prices. Some of the benchmark sources can vary substantially, creating ambiguity in the results of the benchmarking process"* (3PL).

- *Benchmarking can be a valuable tool when trying to establish LTL rates and we use it regularly as part of our pricing process. However, like any other method, you have to be cognizant that benchmarking has its limitations"* (Shipper).

Benchmark pricing tools are widely used and generally understood by the three key groups of market participants addressed in this study. The majority of representatives from each of the

three groups generally agreed that undertaking some form of benchmarking provides a value to their business and enhances the overall industry. While all three groups indicated benchmarking was a common practice, shippers and 3PLs tended to use benchmark pricing practices primarily for establishing standard base rates and for comparison purposes. Alternatively, carriers appear to be adaptable to quoting services using a specific requested base rate but they appear to use benchmark pricing primarily to monitor industry pricing practices and processes.

Theme 3: Classification Rules

Today's LTL motor carrier pricing practices are unique from many other industries as a result of the practices established during the regulated period. Prior to deregulation in 1980, LTL motor carrier freight rates were determined by use of a freight classification system such as the NMFC. The NMFC system attempted to identify relatively homogeneous types of freight and group them into specific freight classifications. Once freight was categorized into the appropriate classification, an appropriate base rate could be assigned to each class of freight.

Once the industry was deregulated, companies were free to exercise business judgment and began to adjust the prices charged for their services. While prices began to change, carriers continued to use the NMFC system as the source for commodity classification because it was so deeply entrenched in the industry. Then, in order to adjust prices in the new era of competition, carriers began to issue discounts off of the published base rates for the various classifications of freight. As carriers expanded their knowledge and understanding of the costs of providing services, they continued to adjust their prices by issuing deep discounts off of the base rates. Over time, the base rates associated with various commodity classifications became less accurate and therefore less meaningful to industry participants. Despite the erosion of its usefulness, use of the NMFC system remains a key part of LTL motor carrier pricing to this day.

- *"Today the base rates that stem from the NMFC's commodity classification process are almost totally meaningless because they do not accurately reflect the price you will pay for LTL motor carriage"* (Shipper).

- *"Over time, the NMFC system's impact on freight categorization has contributed to an erosion in the accuracy of base rates to the point where the rates are no longer at all reflective of the costs associated with providing the transportation service"* (Carrier).

- *"Today's LTL pricing system is unnecessarily confusing and overly complex. Our NMFC based system is not congruent with the density based pricing systems used throughout most of the rest of the world"* (3PL).

While deeply entrenched, the NMFC system is not always extremely useful for determining LTL motor carrier prices. Disagreements over identifying the appropriate classification for a particular type of freight are frequent while the practice and severity of discounts off of rates based on the NMFC freight categorization system has continued to grow. As the NMFC has become less reliable as a viable predictor of commodity categories and, ultimately the costs of transporting a particular type of freight or servicing a particular origin-destination combination, carriers have begun to look for ways to simplify the pricing process. Many carriers responded by starting to use a Freight-All-Kinds (FAK) rate which reduced or eliminated the importance of classifying different types of freight and reduced the need to use the NMFC system.

- *"Continued use of an antiquated and outdated classification system (NMFC) only serves to create*

confusion in the marketplace. While FAK rates have reduced the confusion associated with freight classifications, FAK's are really just another way to offer a discount off of the NMFC's largely meaningless rates" (Carrier).

- *"After 30 years in a deregulated environment, we have adapted to the continued use of the NMFC system and have adapted by using deep discounts off of base rates. The system can be confusing and burdensome to those not familiar with the system, and many feel it is time for change."* (Shipper).

- *"Because the NMFC is somewhat complicated, most customers prefer to pursue an FAK based rate."* (3PL).

The NMFC system is an artifact from the regulated era of motor carriers. While deregulation occurred over 30 years ago, the NMFC system remains in place and continues to play a key role in LTL motor carrier freight categorization and pricing. While significant challenges exist with the use of this system for LTL pricing, the NMFC is so deeply entrenched in the industry that it is likely to continue to play a significant role in LTL motor carrier categorization and pricing processes for the foreseeable future.

Theme 4: Density-based Pricing

Pricing freight on the basis of density, also called cube-based pricing, develops from the idea that the price for transportation services is determined by the weight and space used by the freight being shipped. Density-based pricing is essentially the method major package carriers like FedEx and UPS use to rate package shipments in the U.S. and elsewhere. This form of pricing is widely used with LTL freight outside the U.S., such as in Canada, but has not gained acceptance in the U.S.

Many of the shippers and 3PL study participants believe future LTL pricing will move to a density model. The timing of this transition is unclear with most participants describing the shift to density pricing taking place "in the future", although the majority of statements refereeing to timeframe anticipate a change may occur in the relatively near future (5 years or less). Although customers believe density pricing is on the horizon, carriers consistently downplayed the option. Summing up the broadly-held attitude of carriers, one carrier executive said, "Right now the industry is not ready for cube-based pricing." Nonetheless, customer opinion reflects their interest in this alternative pricing model.

- *"There's got to be a better way to identify the freight and cube pricing is to me a good way. It's a better way than the NMFC pricing we currently have to follow"* (Shipper).

- *"A density tariff definitely will be part of what everybody uses here in the near future"* (3PL).

- *"It's going to take a while, but I think cube is going to take over"* (Shipper).

- *"Everything is moving to density-based items. I know that there are several carriers that already have density-based tariffs waiting in the wings"* (3PL).

Despite customer enthusiasm for a density-based model, respondents pointed to many obstacles that must be overcome before a density model could be implemented. Chief among these issues are concerns over the cost of implementing and operating a density pricing solution for both shippers and carriers. The cost issue consists primarily of concern over the additional time required to capture freight dimensions on the dock and the cost of acquiring the technology needed to determine load proportions.

- *"You'd have to measure each piece of freight...you really don't have the time in a cross-dock environment to stop and measure each shipment"* (Carrier).

- *"The cost involved is significant to change the way that [carriers] operate, change the way that they rate, and to change their internal structures"* (3PL).

- *"The [pallet scanning] technology is expensive and it's still too slow for us to maintain the operational service levels we need"* (Carrier).

Although all three groups raised cost concerns, many shippers may be in a position to accommodate a shift to density driven pricing:

- *"We don't ship anything that we don't measure and weigh. Nothing leaves this facility without a weight and dimensions"* (Shipper).

- *"There's not going to be a cost for me [to switch to a density-based rating system]. We're doing that already"* (Shipper).

Density pricing is generally understood by all three groups and there appears to be support for this method of pricing from many shippers and 3PLs at least. However, the industry does not currently have an organization or a group committed to leading the change effort. As technology improves in the next few years, we believe the cost of capturing dimensional data will drop to a point where that particular barrier will be greatly reduced.

Theme 5: Industry Change Leadership

Many agree that the current LTL pricing system is confusing, inaccurate, outdated, antiquated, and in need of revision or replacement. But what do we change to and who leads the charge to the pricing promised land? It is clear any significant change to current LTL motor carrier pricing practices will require leadership. What is less clear is who should lead the change process.

- *"Carriers must lead the change process since they are the entities charging the price for their services." Those who sell transportation services are in the best position to change the pricing mechanisms and buyers will respond accordingly"* (Shipper).

- *"It's going to take some large shippers to take that lead, because from a carrier standpoint, we're not ready to lead that and put in the cost of implementing something of that nature until it's being asked for."* (Carrier).

- *"We are in the best position to change the pricing process and will need to drive any reengineering to the current pricing process"* (Carrier).

- *"I think you could look at FedEx Freight and UPS Freight as taking the lead and for a couple reasons. One, they've got deeper pockets than anyone else does to invest in that research, and then secondly, they already have the knowledge of how they price that through the small package environment."* (Carrier).

- *"An industry consortium made up of all the major players and led by an independent entity like a professional organization would allow everyone to design a system that would be superior to the current system and hopefully mutually beneficial to all of the players"* (3PL).

While general agreement seems to exist that some type of change to the current LTL pricing system is necessary, no consensus was evident

regarding the leadership needed to push such a sweeping initiative forward. Many participants expressed an opinion on the leadership question, and while no clear support for a specific leader is found in the data, carriers as a group were the most frequently mentioned. However, the potential leader's suggestions covered many options.

CONCLUSION

The nature of pricing in the LTL industry is unusual in that it hasn't evolved in any meaningful way during the three decades since deregulation occurred. The situation is highly unusual given the problems most study participants described with the current system, the overwhelming support for change to a different system, and the fact that studies from more than 20 years ago reported a similar dislike of the status quo at that time (e.g., Baker, 1991; Ying and Keeler, 1991). Clearly the lack of strong leadership needed to drive major change forward is lacking in the industry.

Challenges to any change initiative exist for the industry. Re-indexing, elimination of NMFC codes and density-based pricing are each alternatives that could be pursued independently or in combination. We believe the density option may present the best option for moving forward as most countries outside the U.S. already use some form of density pricing for LTL transportation. Further, the package transportation business is already based on a density pricing structure worldwide and two of the major players (FedEx and UPS) are based in the U.S.

Why hasn't the industry moved beyond a pricing model rooted in the regulated era? One reason is fear of renewed government intervention. Many of the industry insiders we interviewed expressed concern that any type of collaborative industry consortium aimed at bringing participants together to examine possible alternatives to the current pricing mechanism would be improperly perceived as collusion. Given that the history of motor carriage has a strong regulated component and carriers are now enjoying the benefits of operating in a deregulated environment, many industry insiders are hesitant to do anything that would be perceived as a violation of anti-trust laws or any type of behavior considered to be anti-competitive in nature. Overcoming this fear may have to wait on the retirement of this generation of LTL leaders that retain memories of the deregulation experience. Another risk constraining the industry is concern that being an early adopter of any new pricing strategy could backfire. Many leaders see such a change as a "bet the company" strategy, and as such, a risk not worth taking.

We believe the industry will begin to move toward a density-based pricing model by the end of this decade. But, a change agent is needed to lead the way. We anticipate this change agent may emerge in one or a combination of the following three forms.

- Government policy. A major pricing revolution in the motor carrier industry may require government intervention. This would most likely come in a couple of ways. First, it could come in the form of a government assurance and accompanied by guidelines that an industry collaboration dealing with the pricing topic, if handled properly, would not cause concerns about anti-competitive behavior. Government involvement could also come in the form of support and direction from an already existing transportation regulatory body since carriers regularly have to deal with various government entities focused on motor carriers.

- Industry consortium. Many interviewees we spoke with indicated a desire to have an industry consortium of some type lead the

pricing revolution. Many felt that a variety of industry constituent groups (e.g., carriers, shippers, 3PLs and others) should have input into the evolutionary process for motor carrier pricing. It was suggested by several study participants that professional organizations serving the motor carrier and shipper industries could play a vital role in developing and managing a broad consortium of industry participants from various constituent groups.

- A powerful transportation firm. Other participants indicated a large organization perceived to be a leader in the industry could drive pricing change efforts. Several individuals who indicated a large industry leader must serve as a change agent felt it would require new pricing behavior from a large transportation provider to alter the pricing landscape. The general belief is that a large transportation provider would have the clout to change the pricing mechanism for the industry and have other industry participants follow.

While ten years may appear to be a long time to wait in a business context, the basics of LTL pricing have not changed in the three decades following deregulation. This is due in part to fear of government intervention – although few of the "old timers" that worked in the industry when it was regulated remain, the industry has a long memory and many of the participants mentioned a concern that government action could result if any changes were deemed to be anti-competitive or monopolistic. Beyond the fear of government involvement, we believe it will still take several years to work out the leadership challenge.

Qualitative research can provide deeper understanding of a subject and establish a direction for future investigations into an area of interest. We believe the qualitative approach used in this study has shed new light on the under-explored topic of LTL pricing. All study findings are preliminary, and certainly our conclusions are tentative and require follow-up using other methods and larger samples before they should be generalized to any extent. We hope the analysis offered, while perhaps not immediately testable, can serve to drive further research in this area and lead to research that re-visits these topics in a few years.

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CONCENTRATION IN THE AIRLINE INDUSTRY: EVIDENCE OF ECONOMIES OF SCALE?

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ABSTRACT

The early experience of the airline industry under deregulation was very much as expected, with increased competition and new entrants offering highly competitive rates. However, there are approximately 130 airlines operating today, and the industry remains more heavily concentrated than it was prior to deregulation. This study reports on concentration in the US airline industry between 1970 and 2009, as measured by the Herfindahl-Hirschman Index (HHI) and Concentration Ratio, together with changes in industry costs. The results show a trend of industry-wide reduced costs per available seat mile that is negatively correlated with the increased level of industry output over the last 30 years and increased concentration, which demonstrate the need for more research into the question of scale economies in air transportation.

INTRODUCTION

Prior to passing the Airline Deregulation Act of 1978, members of Congress wanted to be assured that eliminating federal economic regulation would result in neither destructive competition, nor increased concentration within the industry, which could lead to the threat of monopoly abuse or increased prices. Research presented before Congress provided a very convincing argument that neither condition would develop (U.S. Senate, 1975; U.S. House, 1976; White, 1979; Kyle and Phillips, 1985; Antoniou, 1991). Moreover, since there was no investment in the way required, entry was believed to be relatively easy due to low capital requirements and the flexibility with which equipment could be acquired, reassigned, and/or retired (Harper, 1982; Levine, 1987; Dempsey, 1993). This belief of easy entry was reinforced by the concept of Contestable Markets, which suggested that the potential threat of entry could keep prices down, even in markets with only one competitor (Baumol, Bailey, and Willig, 1977; Panzar and Willig, 1977; Bailey and Panzar, 1981). Thus, Congress passed the 1978 legislation with the belief that it would bring about an increase in the number of competitors and a decrease in the level of industry concentration, leading to lower rates and better service throughout the airline industry.

The early experience after deregulation was very much as expected. There was a rush of new entrants into the market, rates became highly competitive, and the industry became less concentrated. In 1978, there were 33 airlines serving U.S. markets (A4A, 1979). In 1979, the first year after deregulation, 18 new carriers entered the market and another 13 entered the following year. By 1985, there were 106 airlines operating scheduled service in the US. (A4A, 1986). By the end of the decade, however, many of the new carriers had exited the market and the industry was more concentrated than ever (Kahn, 1988; Borenstein, 1992; Rakowski and Bejou, 1992; Dempsey, 1993; Brueckner and Spiller, 1994; Goetz and Sutton, 1997). This led Alfred Kahn, former Chairman of the Civil Aeronautics Board and one of the strongest proponents of deregulation, to question the outcome of the 1978 legislation (Kahn, 1988). Others actually called for re-regulation of the industry

(McGinley, 1989; Dempsey, 1990; Nomani and Barrett, 1990). However, there was continued belief in the positive results of deregulation and strong support for the new environment (Gattuso, 1986; GAO, 1991; TRB, 1991), so no action was taken.

Throughout the 1990s, the trend toward fewer, larger carriers continued due to bankruptcies and mergers (TRB, 1999; DOT, 2001); however, new competitors continued to enter the market, and the overall number of carriers increased. By 1997, there were 99 airlines servicing U.S. markets (A4A, 1998), compared to just 66 in 1991 (A4A, 1992). With the new millennium came additional carriers, and in 2003, 150 airlines were providing service to U.S. markets (A4A, 2004). As mergers and bankruptcies reduced the number of carriers, they were replaced in part by new ones. In 2004, there were only 139 carriers, but by 2008 the number was back up to 150 (A4A, 2006, 2009). Still, questions regarding concentration in the airline industry have continued, together with persistent calls for re-regulation (Senate, 2001; Staff, 2001; USDOJ, 2001; Isadore, 2007; McGee, 2008; Lowy, 2010).

Increasing levels of industry concentration seem contradictory to increasing numbers of competitors, but studies noting levels of industry concentration have not been published recently. Yet levels from the late 1980s and early 1990s appear to remain valid since complaints against the industry continue to link bankruptcies and merger activity to industry concentration and "unreasonable" fares and poor service (GAO, 2006; Isadore, 2007; McGee, 2008; Lowy, 2010). However, questions arise as to whether these concerns are justified. Moreover, it is important to know whether the levels of concentration in the airline industry have continued to increase, or if the new carriers entering the market in recent years have led to reductions.

This study reports on changes in industry concentration in the U.S. airline industry between 1975 and 2009. This study also reports on changes in industry costs and revenues over this period. The following section provides a brief overview of the two most popular measures of industry concentration, those used in this study, and a review of previous studies of concentration in the airline industry. This is followed by a description of the data, and then the results of the analysis are presented. Finally, conclusions and suggestions for future research are discussed.

MEASURING INDUSTRY CONCENTRATION

The concept of industrial concentration has been studied extensively over the years, and many measures have been proposed. Bikker and Haaf (2002) reviewed 10 different measures that had been used in studies of concentration in the banking industry. The two most common measures include basic concentration ratios (CR) and the Herfindahl-Hirschman Index (HHI). These measures are discussed briefly below, and this is followed by a brief review of studies of industry concentration in the U.S. airline industry.

Concentration Ratios

Basic concentration ratios (CR_k) measure the proportion of industry revenue earned by the k largest firms in the industry. The most frequently used values of k are 4 and 8, providing the four-firm (CR_4) and eight-firm (CR_8) measures, respectively (Bain, 1951, 1954; Scherer and Ross, 1990; Bikker and Haaf, 2002; Snyman, 2010). Basic concentration ratios are seen as inferior to other measures of concentration, such as HHI, because they don't take into account the behavior of any firms other than the four or eight largest. Also, many different distributions of those largest firms would result in equivalent measures of CR_4 and CR_8. Despite these shortcomings, concentration ratios have been found to correlate highly with the HHI (Scherer and Ross, 1990) and continue to be used. Economists researching concentration ratios have predominately looked for critical values of measures that are positively correlated with

higher profitability (Schmalensee, 1987; Bikker and Haaf, 2002). The idea being that when large firms begin to behave as an oligopoly, their profitability tends to increase because the large firms can easily see what their competitors are charging and charge a similar amount. Several different numbers have been proposed as the critical value, but for CR_4 the critical value generally is considered to be between 45 and 55 percent, and for CR_8 it is between 60 and 70 percent (Bain, 1951; Meehan and Duchesneau, 1973; Dalton and Penn, 1976).

Herfindahl-Hirschman Index

The Herfindahl-Hirschman Index (HHI) is the sum of the squared market shares for each firm in a given industry (Rhoades, 1993; Nauenberg, Basu and Chand, 1997; Bikker and Haaf, 2002). This gives proportionally greater weight to firms with large market shares and "reflects both the distribution of the market shares of the top four firms and the composition of the market outside the top four firms" (Rhoades, 1993; USDOJ, 1997).

The Herfindahl-Hirschman Index (HHI) is generally accepted as a better measure of industry concentration than basic CRs, and it is the measure used by the U.S. Department of Justice (USDOJ) in determining whether a proposed merger deserves further investigation before approval (USDOJ, 1997). The HHI ranges from 0 to 10,000 for industries ranging from perfect competition to monopoly. As an example, an industry with four firms with the following market shares (40, 30, 20, and 10) would have a CR_4 of 100% and a HHI of 3,000. If the industry was more concentrated, as with the following market shares (80, 10, 5, and 1), the CR_4 would still be 100%, but the HHI would be 6,526. Finally, for a monopoly the CR_4 would still be 100%, but the HHI would be 10,000.

According to the guidelines set forth by the USDOJ and the Federal Trade Commission, an industry with an HHI lower than 1,000 is considered un-concentrated, and mergers need not be analyzed. An industry with an HHI between 1,000 and 1,800 is considered moderately concentrated and mergers that create an increase in HHI greater than 100 points raise competitive concerns and need to be approved. Finally, an industry with an HHI greater than 1,800 is considered highly concentrated, and mergers causing an increase of greater than 50 points raise competitive concerns (USDOJ, 1997). As with concentration ratios, the HHI can be measured using market shares expressed in either dollar terms or physical terms, such as units sold or revenue passenger miles (RPM).

STUDIES OF AIRLINE INDUSTRY CONCENTRATION

By the end of the first decade of deregulation, it was clear that the industry was changing dramatically. This prompted a wave of research assessing the results of deregulation. Several studies analyzed the effects of mergers and concentration on fares at the route-level or at airports/hubs (Hurdle et al., 1989; Borenstein, 1990, 1991, 1992; Joesch and Zick, 1990; Morrison and Winston, 1990; Abramowitz and Brown, 1993; Kim and Singal, 1993). These studies revealed mixed results, such that in some cases fares were lower in heavily concentrated markets and in others fares were higher. What was revealed was that other factors must be considered together with the level of concentration. Others studies challenged the Theory of Contestable Markets, noting that firms may prevent entry of new carriers without lowering prices. This could be accomplished by development of Hub-and-Spoke Systems, Frequent Flyer Programs, Computerized Reservation Systems, Travel Agent Commission Overrides, and control at "Fortress Hubs" of airport slots and gates (Levine, 1987; Borenstein, 1989, 1992; Fawcett and Farris, 1989; Hurdle et al., 1989; Evans and Kessides, 1993b; Joesch and Zick, 1994).

Very few studies reported concentration at the industry level, and most of these studies were conducted during the wave of research that assessed the effects of deregulation at the end of the first decade of experience; very little

attention has been given to industry-level of concentration in recent years. Rakowski and Bejou (1992) showed that in 1977, the largest 15 airlines controlled over 95 percent of the market in terms of passenger revenues. The largest 8 controlled nearly 80 percent, and the largest four controlled over half. By 1985, those numbers were down to 91, 71, and 41, respectively. However, by 1989 the concentration ratios were back up above 1977 levels with the largest 15 carriers controlling 99 percent, the largest 8 with over 91 percent, and the largest 4 at nearly 55 percent.

Borenstein (1992) reported the CR_4, CR_8, and HHI for 1977, 1982, 1987, and 1990. The 4-firm ratios were 56.2, 54.2, 64.8, and 61.5, for 1977, 1982, 1987, and 1990, respectively. The 8-firm ratios were 81.1, 80.4, 86.5, and 90.5, for those same years, and the HHIs were 1060, 930, 1230, and 1210, respectively. Evans and Kessides (1993a) reported measures of concentration for the fourth quarters of 1978-1988. The CR_4 decreased from the 4th quarter of 1978 to a low of 38.4 by the 4th quarter of 1985; however by the 4th quarter of 1988, it was back up to 45.5. The CR_8 fell from 77.6 in 1978 to a low of 40.7 in 1985 and then increased to 78.0, its highest level up to that point. The HHI fell from 930 in the 4th quarter of 1978 to a low of 630 in 1985, and rose steadily through 1988 to 870.

Brueckner and Spiller (1994) showed a similar pattern of change in industry concentration as measured by Revenue Passenger Miles. They reported the CR_4 as 59.1, 53.6, and 59.1 for 1979, 1985, and 1988, respectively. Clearly, the pattern was well established. The initial response to deregulation was the entry of several new carriers and more extensive competition, but by the end of the decade, most of the new carriers were gone, and the industry was more heavily concentrated than it was prior to deregulation. Mergers and bankruptcies have continued to raise the ire of consumers and public policy makers (Senate, 2001; Staff, 2001; USDOT, 2001; Isadore, 2007; McGee, 2008; Lowy, 2010), but little is known about the actual levels of concentration in the industry and its relationship to overall fare levels and costs.

DATA

The data used in this analysis were obtained from the annual reports published by the Airlines for America (A4A). These reports, dating back to 1937, report information on the general state of the industry such as total revenue, expenses, revenue passenger miles (RPM), available seat miles (ASM), and names of all U.S. carriers with scheduled passenger service. In addition to this industry-wide information, similar financial and production information is reported for the largest carriers each year dating back to 1970 (A4A, 2009). Table 1 provides an overview of the U.S. airline industry with respect to the number of carriers, total passenger revenue, operating profit and four measures of industry concentration for the past 40 years. To show trends in pricing and cost data, it was necessary to adjust dollar figures for inflation. This was accomplished by dividing by the implicit price deflator (IPD) as reported by the Bureau of Economic Analysis (2011). The specific IPD used was based on annual GDP with a base year of 2005.

NUMBER OF CARRIERS

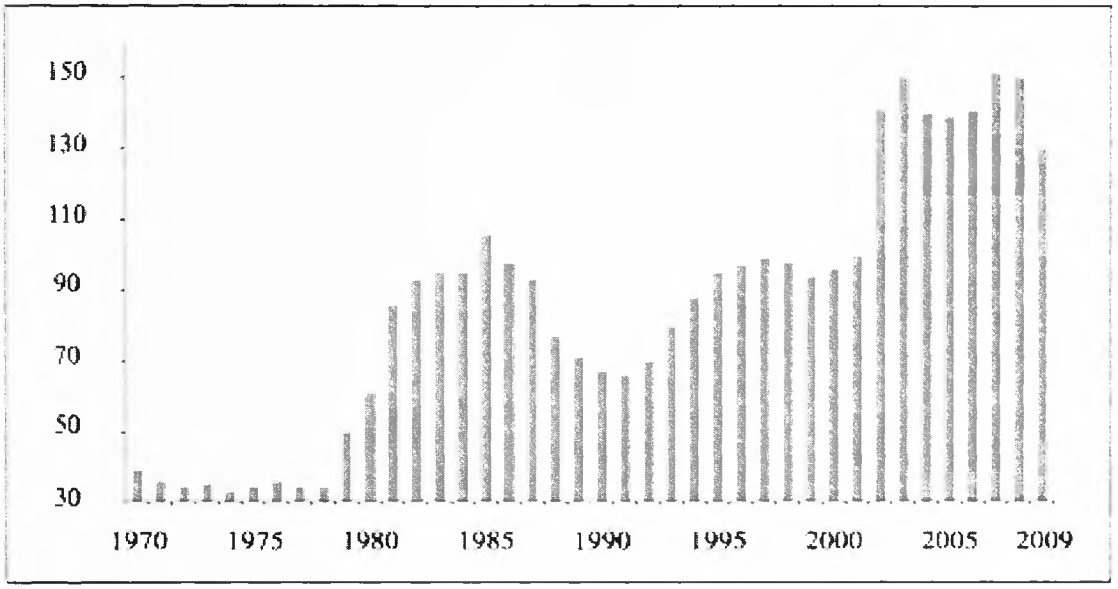
An expected result of airline deregulation was an increase in the number of carriers serving the U.S. scheduled passenger service market because of reduced barriers to entry. Figure 1 shows that the number of carriers has increased dramatically since deregulation. Between 1978 and 1985, there was a significant increase in the number of carriers with new entrants into the market; however, during that period there were also many small carriers that exited the market. By 1985, 9 of the 34 airlines that existed in 1978 and 11 of the 17 that entered the market in 1979 had exited the market. The number of carriers peaked in 1985, declined through 1991, and has trended upward through 2009 with a few minor declines.

With this significant growth in the number of carriers, one would expect to see a corresponding decrease in the concentration of

TABLE 1:
INDUSTRY OVERVIEW

Year	Number of Carriers	Passenger Revenue ($ Billions)	Operating Profit ($ Billions)	RPM (Billions)	ASM (Billions)	CR4	CR8	HHI	Gini Index
1970	39	31.3	0.2	131.7	264.9	57	83	1,076	78
1971	36	32.2	1.2	135.7	279.9	56	82	1,037	76
1972	34	34.9	2.2	152.4	287.4	57	83	1,056	75
1973	35	36.5	2.1	162.0	310.6	54	83	1,024	76
1974	33	38.7	2.4	162.9	297.0	53	83	1,015	74
1975	34	36.8	0.3	162.8	303.0	53	82	995	74
1976	36	40.2	2.0	179.0	322.8	53	82	992	76
1977	34	43.1	2.4	193.2	345.6	52	81	978	74
1978	34	46.5	3.4	226.8	358.8	53	81	1,004	74
1979	50	52.0	0.5	262.0	416.0	50	79	901	81
1980	61	58.7	-0.5	254.2	431.2	49	80	920	83
1981	86	58.5	-0.8	248.8	432.5	47	76	853	87
1982	93	55.1	-1.3	259.0	424.9	47	77	854	87
1983	95	56.8	0.5	281.3	463.4	48	76	860	86
1984	95	61.8	3.6	304.5	514.0	46	74	817	86
1985	106	63.7	2.3	335.9	547.0	45	73	782	88
1986	98	63.6	2.1	366.3	606.8	48	74	833	87
1987	93	69.3	3.8	404.3	648.4	51	84	989	90
1988	77	75.4	5.2	423.3	648.7	53	85	1,027	89
1989	71	77.2	2.7	432.7	684.4	57	87	1,094	89
1990	67	80.9	-2.6	457.9	733.4	57	88	1,111	89
1991	66	76.2	-2.4	447.8	715.0	63	90	1,230	89
1992	70	78.0	-3.1	478.1	751.8	69	94	1,407	92
1993	80	81.7	1.8	489.1	770.8	69	93	1,407	92
1994	88	81.1	3.5	518.2	783.8	68	91	1,347	92
1995	95	85.1	7.2	540.4	806.6	67	89	1,312	92
1996	97	88.2	7.5	578.4	834.7	66	89	1,280	92
1997	99	93.9	10.2	605.4	860.6	66	89	1,278	92
1998	98	94.6	10.9	619.5	874.2	65	89	1,273	92
1999	94	96.9	9.1	651.6	917.8	64	89	1,233	92
2000	96	105.5	8.0	692.5	956.5	62	88	1,185	91
2001	100	89.2	-11.1	651.7	930.5	64	89	1,244	92
2002	141	79.5	-9.3	639.6	892.7	62	87	1,185	93
2003	150	81.8	-2.3	655.9	893.9	58	83	1,069	92
2004	140	88.5	-1.4	731.9	969.0	57	81	1,029	91
2005	139	93.4	0.3	779.0	1,003.3	55	83	1,028	91
2006	141	98.0	7.3	797.4	1,006.4	54	82	1,007	92
2007	151	100.7	8.7	829.0	1,037.1	53	81	968	91
2008	150	102.8	-3.3	811.4	1,020.1	61	83	1,188	92
2009	130	83.2	2.2	769.5	952.2	60	83	1,157	92

FIGURE 1:
NUMBER OF U.S. AIRLINES 1975-2009



the industry and equality of carriers' market share, especially if there were no economies of scale. That is, if all carriers, regardless of size, had the same costs per unit of output, the concentration today should be lower than the concentration was in 1975 because the new entrants into the market would be able to take significant amounts of market share from the industry leaders. This is not the case, however, and the following sections will illustrate that industry concentration and inequality has actually increased over this time period.

CONCENTRATION RATIOS

Figure 2 shows a graphical representation of the annual four and eight firm concentration ratios calculated using market shares measured in both dollar sales and units sold between 1975 and 2009 as well as the most conservative (highest) critical values of CR_8 and the range of critical values for CR_4. From this figure, it is obvious that the airline industry is currently operating above these critical values and has been for most of, if not all of, the past 35 years. This suggests that the industry is behaving as an Oligopoly and is a highly concentrated industry. This can be further verified by the fact that ticket prices for the same lane among the largest airlines are generally very similar, and when checked baggage fees were added in 2009 they were added for all of the largest airlines, with the exception of Southwest Airlines, which, as of 2011, doesn't charge a checked baggage fee but frequently charges slightly higher ticket prices than the other major national airlines. However, an industry behaving as an oligopoly should have higher profitability (Bikker and Haaf, 2002), and this is not the case in the U.S. airline industry, where industry profits per unit of output have remained fairly constant over the past 40 years.

HERFINDAHL-HIRSCHMAN INDEX

Figure 3 shows the HHI calculated annually for the U.S. airline industry from market shares measured in terms of both dollar sales and units sold. Both methods result in measures of HHI that are very similar at every point in the sample. This illustrates that the airline industry is moderately concentrated and has been for most of the past 35 years. It is also clear that when the number of carriers was increasing, between 1978 and 1985, the concentration of the industry was decreasing. However, when the number of carriers began decreasing between 1985 and 1991, the concentration increased rapidly, and

FIGURE 2:
ANNUAL CR_4 AND CR_8 of U.S. AIRLINE INDUSTRY

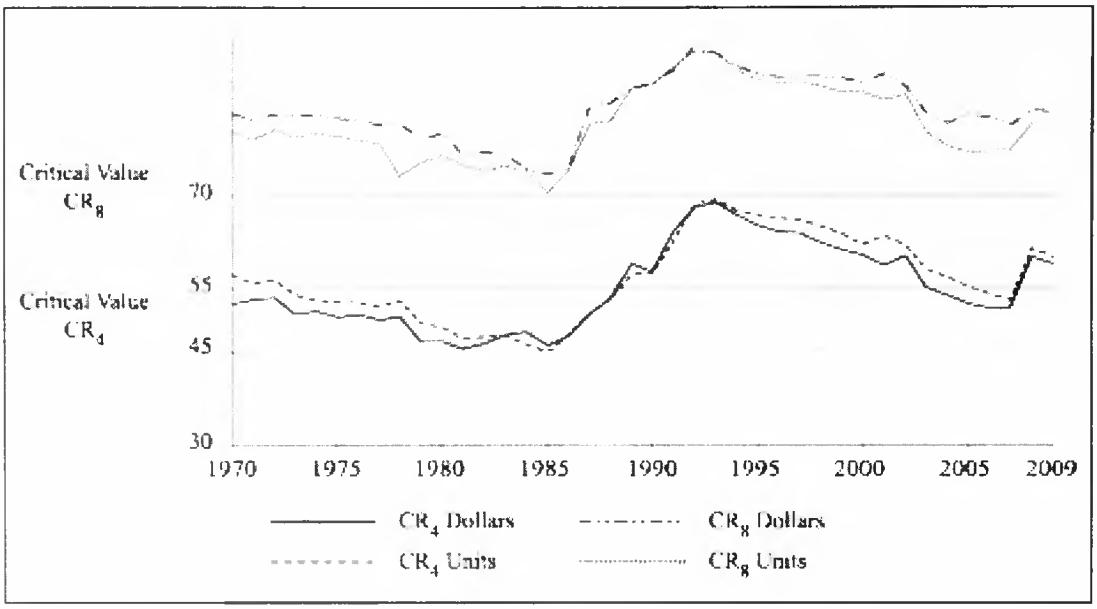
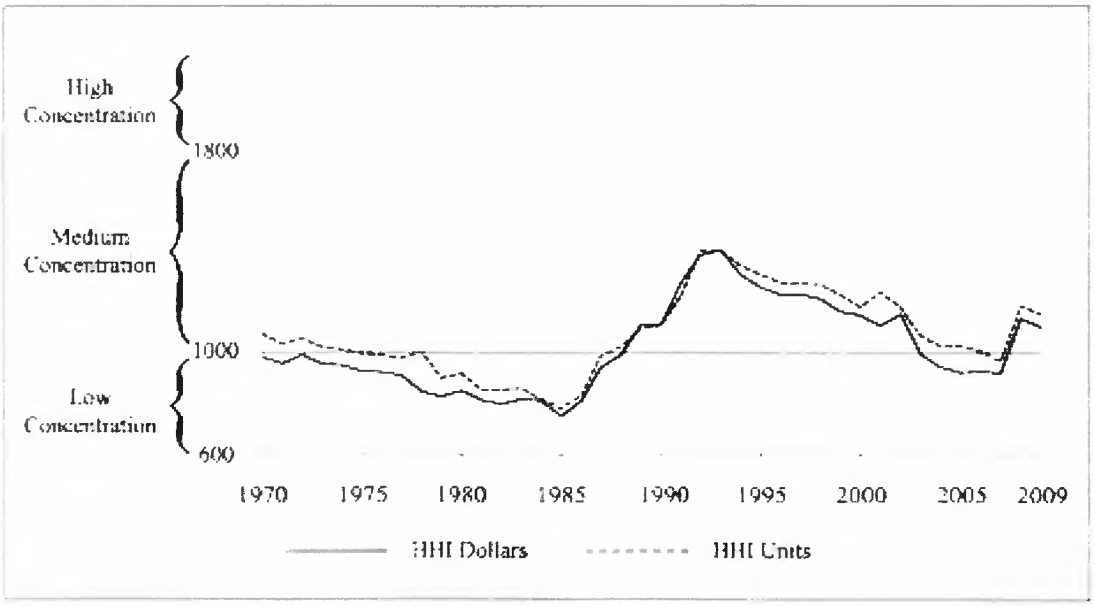


FIGURE 3:
ANNUAL HERFINDAHL-HIRSCHMAN INDEX (HHI) OF U.S. AIRLINE INDUSTRY



did not decrease dramatically as more carriers later began to enter the market. Therefore, despite the fact that there are between 4 and 5 times as many carriers today as there were in 1978, the HHI is actually higher. The large firms have increased their market share and the small firms are dividing a decreasing percentage of the market between them. This indicates that there is some reason the large firms are able to increase their power, whether it is due to economies of scale, scope, or density.

INEQUALITY

When discussing industry concentration, it makes sense to also discuss the related concept of inequality of the distribution of market share of the firms in the industry. A common way to measure inequality is the Gini index (Damgaard and Weiner, 2000). The Gini index is based on Pareto's law and is the ratio of the area between a diagonal representing equal distribution and the Lorenz curve and the area below a diagonal representing equal distribution. In the Lorenz curve, individuals are ranked by size, and the cumulative percentage of carriers is plotted on the x-axis against the corresponding cumulative percentage of the market on the y-axis. In figure 4, the Lorenz curve for the U.S. airline industry in 2009,

$$Gini = {}^{A}/_{(A+B)}. \quad (1)$$

To make computation easier and avoid the estimation of a formula for the Lorenz curve, the following formula is an unbiased estimator of the Gini index if the carriers are ranked by size (Damgaard and Weiner, 2000), where x_i is the size or market share of each carrier and μ is the average size of all carriers.

$$Gini = {}^{\sum_{i=1}^{n}(2in - 1)x_i}/_{(1 - n)n\mu} \quad (2)$$

Figure 5 shows the Gini index for the U.S. airline industry for the past forty years calculated using size measured in both passenger revenue and RPM. This shows that inequality in the industry increased significantly immediately following deregulation and has continued to do so. If there was no benefit to being a larger carrier (no returns to scale or scope), we would expect to see the industry approaching a more equitable distribution of the market when in fact the opposite has been the case. Furthermore, the correlation between the Gini index and number of carriers is 0.8165, indicating that as the number of carriers increases so does the inequality in market share between carriers.

These multiple measures of industry concentration and inequality were examined to clearly illustrate that the concentration of the U.S. airline industry has been increasing since deregulation despite the fact that there has been a substantial increase in the number of firms. While this alone, does not indicate economies of scale or scope, it certainly raises questions as to how the largest firms have been able to maintain control of the marketplace and actually increase market share with the near constant introduction of new competitors. One possible explanation might be that operating costs per unit of output are actually lower for the larger carriers. If this explanation is accurate, it would indicate the presence of economies of scale, economies of scope, or both in the airline industry.

COST AND REVENUE PER PASSENGER MILE (RPM)

Since 1975, there has been an increase in the size of the airline industry as a whole. This can be measured by revenue (dollar sales), RPM (unit sales), or ASM (output). All three measures have shown an increasing trend since 1975 and can be seen in Figure 6. In order to fit data of differing scales on the same graph and show the increasing trends more clearly, revenue, RPM, and ASM have been indexed with a base year of 1975 by dividing each year's value by the value from 1975. The revenue values were adjusted for inflation before being indexed. Figure 6 clearly shows an increasing trend in the size of the U.S. airline industry, but it also shows that output and units sold have been increasing more rapidly than revenue. This is another indication of scale economies and shows that costs have risen less quickly than output.

FIGURE 4:
CALCULATION OF THE GINI INDEX

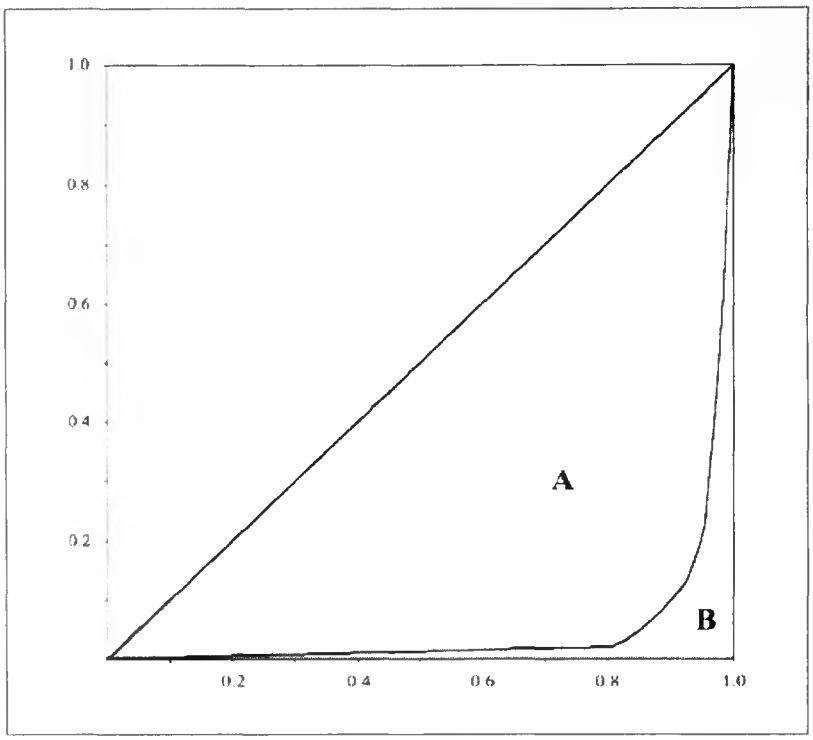


FIGURE 5:
GINI INDEX OF U.S. AIRLINE INDUSTRY

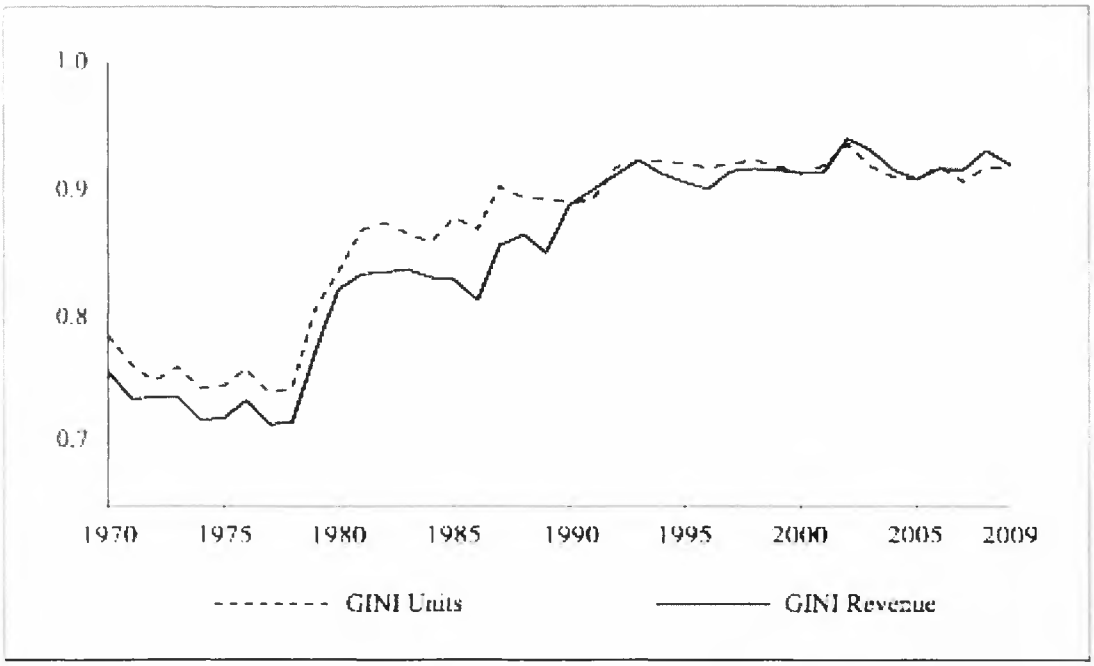


Figure 7 shows the increase in billions of RPM sold for what are, as of 2010, the three largest airlines in the U.S. (United, American, and Delta) for each year between 1975 and 2009. This figure illustrates that not only has the entire industry been increasing in size, but the largest firms have also been increasing. Figure 7 also shows that the period from 1979-1985 resulted in a relative lack of growth for these three carriers while the industry as a whole was growing. This lack of growth for the large carriers as the industry grew corresponds to what was shown in figures 1-3, that the number of firms increased in this time period and the industry concentration, as measured by CR_4, CR_8, and HHI, decreased.

Correlated to the growth of the industry was an equally impressive decrease in both expenses and revenue per RPM and ASM. This can be seen in Figure 8. This figure is based on monetary figures, which were adjusted for inflation by dividing each year's observation by the corresponding IPD. This is another indicator that economies of scale or scope may exist in the airline industry. The correlation between industry output (measured in either RPM or ASM) and expenses per RPM is -0.86.

However, the fact that revenue per unit of output has decreased at nearly the same rate indicates that the carriers do not appear to be acting as though they are market leaders in a concentrated industry. Actually, the correlation between sales per RPM and output is even higher at -0.96, indicating that the price of air travel has decreased more quickly than the cost of providing air travel. For those interested in re-regulation, this raises the question of whether the current state of the industry and competition is bad for the consumer. Presumably the role of regulation would be to help the consumer and maintain competitiveness in the industry. However, the industry seems to be lowering prices even faster than expenses, suggesting that competition is keeping prices low despite high levels of industry concentration.

FIGURE 6:
ANNUAL INDEXED MEASURES OF INDUSTRY SIZE (1970=1)

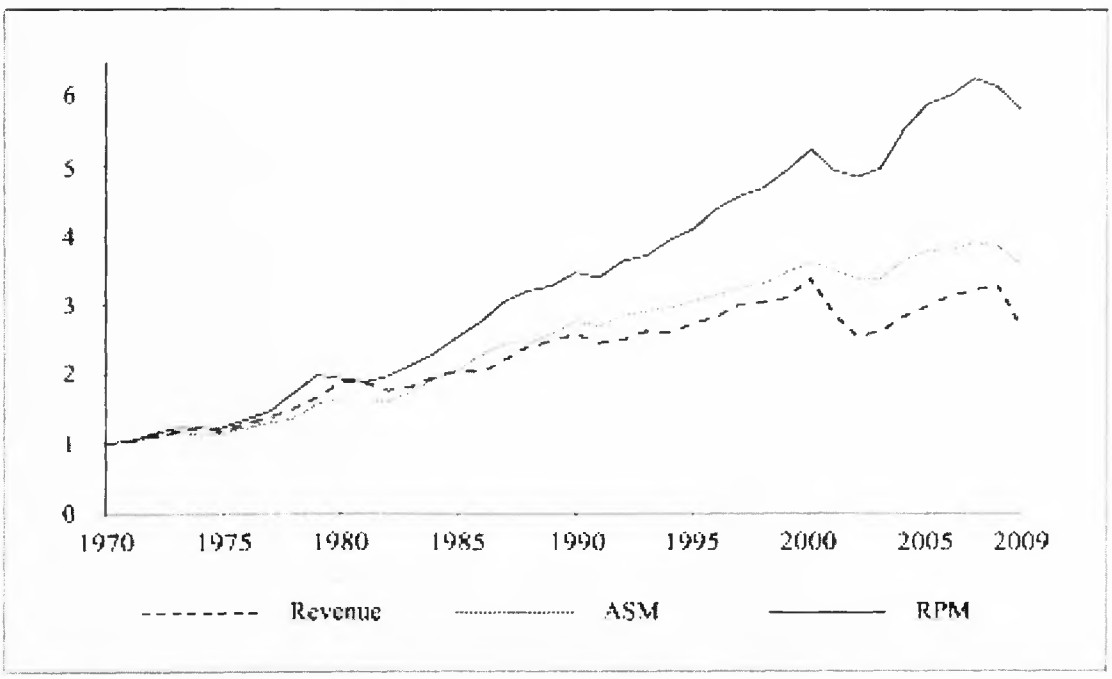


FIGURE 7:
ANNUAL RPM (BILLIONS) OF 2009's 3 LARGEST CARRIERS

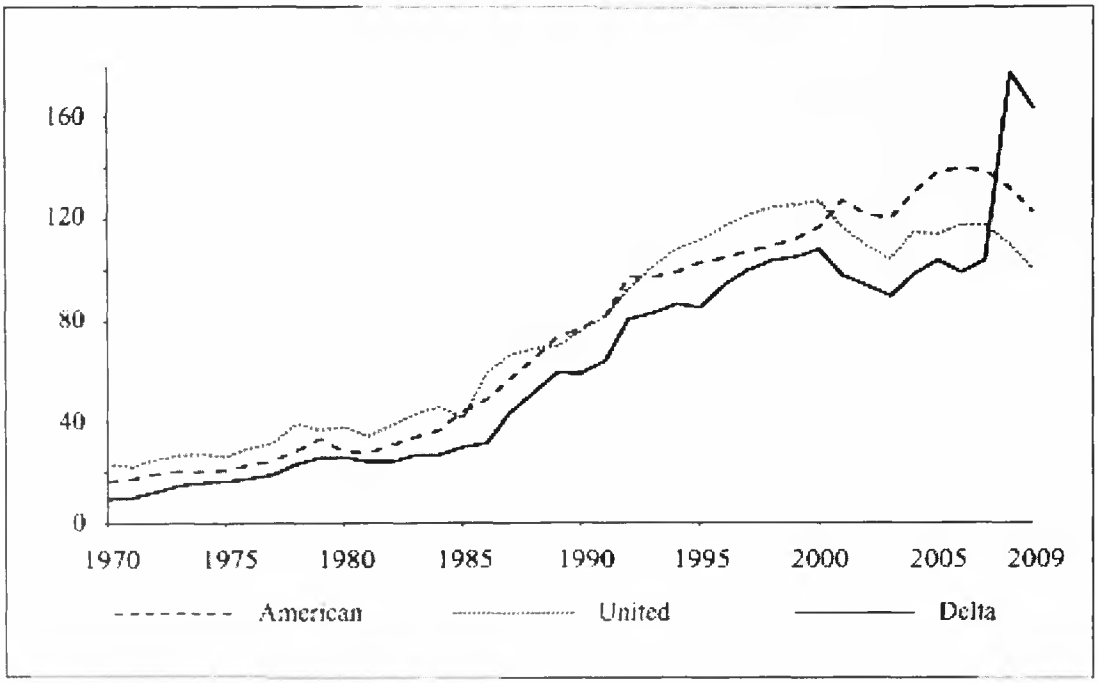
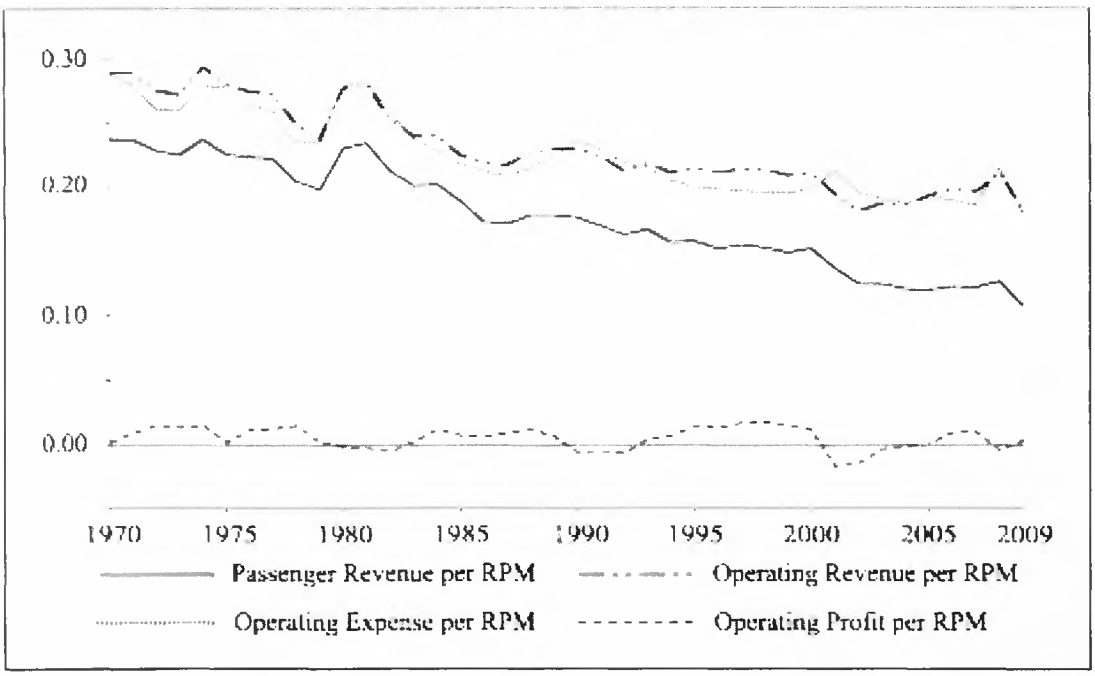


FIGURE 8:
REVENUE, EXPENSES, AND PROFIT PER REVENUE PASSENGER MILE



The bottom line on Figure 8 illustrates the profit per RPM, and this measure has stayed fairly stable over the past 35 years. In fact, the entire industry lost money 11 out of the past 35 years. If this is a result of destructive competition, there may be a need for regulation simply to keep the large carriers from losing money or requiring governmental monetary intervention to avoid bankruptcy. The entire industry has lost approximately $9 Billion since 2001. However, this is more likely the result of a few large firms losing a lot of money rather than all of the major carriers losing money. Based on information from their annual reports to the SEC, America West and U.S. Airways combined, pre-merge, and post merge losses since 2001 have totaled close to $8 Billion, leading to the conclusion that the rest of the industry only lost $1 Billion; this includes at least 40 bankruptcies, with at least 12 of the bankruptcies resulting in the cessation of operations.

These findings support reregulation of the airline industry in that they provide evidence of economies of scale, and a major reason for deregulation was a multitude of studies showing a lack of scale economies in the industry. The industry has concentration ratios indicating that it should be behaving as an oligopoly, all measures of concentration show increased concentration ratios since deregulation, and cost per unit of output has steadily decreased as output has increased. Contrary to this evidence is the fact that price per unit of output has decreased even faster than costs. This reduced price is beneficial to consumers as long as destructive competition does not drive prices down so far that the established carriers are forced out of business. However, it has been pointed out that the majority of industry losses over the past 9 years have been the result of two carriers who merged.

MERGERS AND ACQUISITIONS

The final piece of evidence that there may be economies of scale in the U.S. airline industry is the recent abundance of mergers and acquisitions. If there are no cost benefits from increased size of operations, why are there so many mergers? The following is an account of some of the recent mergers: American Airlines purchased the assets of the bankrupt Trans World Airlines in 2001. America West and U.S. Airways (both with recent bankruptcies) merged in 2005 and integrated their operations in 2008. Delta and Northwest merged in 2008. United Airlines and Continental Airlines merged in October of 2010. ExpressJet Airlines merged with SkyWest/ASA in November of 2010. Finally, Southwest Airlines announced a merger with AirTran Airways in September of 2010 which was finalized May 2, 2011.

While many carriers are merging operations, there are also several instances of a single holding company owning multiple carriers. This would further suggest that the carriers see no possibility of economies of scale. However, in some cases, these are the same companies that were previously mentioned. For example, Delta Airlines owns Comair and operates it separately; AMR Corporation owns American Airlines, American Eagle, and Executive Airlines; U.S. Airways Group owns U.S. Airways, Piedmont Airline, Inc., and PSA Airlines; and Republic Airline Holding owns Frontier, Republic, Shuttle America, Chatauqua, and Midwest. This indicates that mergers may not be attempts to exploit economies of scale but may be due to some other rationale.

CONCLUSIONS

This paper is intended to investigate the state of the airline industry, show its increasing level of concentration, and point out the need for further investigation into the existence of scale economies. Whether industry concentration is measured by concentration ratios or the HHI, the U.S. airline industry has been increasing in concentration while also increasing in size and number of carriers. The fact that large carriers can increase market share in the presence of increased competition seems to suggest the existence of scale economies. Costs per unit of output have been steadily decreasing as industry output and output of the largest carriers has

increased. This is yet another indicator that scale economies may exist. Finally, some air carriers behave as though they will see a benefit from merging with other carriers, indicating a belief or hope that scale economies exist, while other companies own multiple carriers without merging operations, indicating that they see no benefit from increasing the size of operations. For this reason alone, it may be time to reinvestigate the existence of scale economies in the U.S. airline industry, so airline holding companies will know if they could expect to see reduced cost from merging operations instead of operating multiple carriers.

For all of these reasons, the apparent shifts in market structure as seen by changes in equality in Figure 5, and the recent calls for re-regulation; it seems as though there exists a need for further investigation into the presence or absence of economies of scale and scope in the U.S. airline industry. Further validating this argument, is the fact that the most recently published study into this matter, while published in 2001, used data from 1983-1989 (Creel and Farrell, 2001). This means that an additional 20 years of available data has not been included in any previous studies on scale economies in the U.S. airline industry. It is time for a thorough study using the most up to date information to investigate the existence of economies of scale, scope, and density.

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COMPETITIVE ADVANTAGE AND FUEL EFFICIENCY IN AVIATION

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ABSTRACT

This paper builds upon a resource based view of competitive advantage under a dynamic capabilities construct. Fuel efficiency measurement in the aviation industry can be incorporated into dynamic capabilities such as strategic decision making and alliancing. These dynamic capabilities can drive operational cost reductions, which in-turn can enhance profitability and establish a competitive advantage. To further this advantage, fuel efficiency can be embedded inside an organizational culture. A fuel efficiency focused organizational culture can be a valuable, rare, inimitable and non-substitutable resource. This paper proposes a model to merge the dynamic capabilities of strategic decision making and alliancing with organizational culture under fuel efficiency. Under this model, a fuel efficiency index is introduced to drive behavior and provide accountability. Effective use of the index has profit potential.

INTRODUCTION

A firm's efficient utilization of resources can be a source of competitive advantage. For the aviation industry, the resource that makes up the largest component of total cost is fuel. Aviation industry fuel encompassed 20% of total costs in 2007 and United Airlines saw their cost of fuel, as a percentage of total cost, vary between 10% and 25% from 1973 to 2006 (Mazraati, 2010). A dynamic capability to obtain the efficient use of fuel and reduce those costs could lead to a sustained competitive advantage.

Barney (1991) suggests a rationale for a resource based view of sustained competitive advantage. The two main assumptions of this view are that a firm's resources are heterogeneous and that those resources may be immobile across firms. In addition, resources that provide for a sustained competitive advantage must be valuable, rare, inimitable and non-substitutable. Fuel is not rare or inimitable. Fuel as a resource therefore will not provide for a sustained competitive advantage. Yet, a firm's dynamic capabilities properly applied to fuel efficiency can achieve that advantage. Eisenhardt and Martin (2000) expanded upon Barney's resource based view model by adding dynamic capabilities as potential sources of sustained competitive advantage.

AVIATION FUEL EFFICIENCY AND DYNAMIC CAPABILITIES

Dynamic capabilities as defined by Eisenhardt and Martin are those "organizational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve and die." Some examples given of dynamic capabilities include alliancing, product development and strategic decision making. Eisenhardt and Martin suggest that dynamic capabilities can be a source of competitive advantage by altering a firm's resource base. The efficient utilization of fuel in the aviation industry is dependent upon alliancing, product development and strategic decision making. A model for implementation of a fuel efficiency strategy can be seen in Figure 1.

The model's three elements — strategic decision making, supply chain fuel efficiency and an organizational culture of fuel efficiency directly impact a firm's operational fuel efficiency. Strategic decision making concerning fuel efficiency involves strategic investment and strategic planning. Strategic investment

FIGURE 1
AVIATION INDUSTRY FUEL EFFICIENCY MODEL

involves the acquisition of aircraft, software, ground equipment and infrastructure improvements. Examples of each of these categories can be seen in Table 1. The critical factor in all of these strategic elements is to consider their fuel efficiency impact on operations. This impact is associated with a purchased item's fuel efficiency and weight. Strategic investments need to consider weight minimization as an important requirement. Strategic planning involves location management and process decisions. Location management decisions include the basing of aircraft, ground equipment, facilities and maintenance repair capability. The goal of location management is to optimize requirement flow with minimum fuel usage. Process decisions include initial process design for fuel efficiency, process redesign for fuel efficiency and accountability for fuel efficiency. Metrics need to be designed to drive behaviors that increase fuel efficiency in these strategic areas.

Supply chain fuel efficiency involves alliancing. Partnering with other firms in the supply chain can result in significant fuel efficiency enhancements. Examples include information technology collaboration that shares aircraft schedules and loads with cargo distribution centers to optimize load factors. Another potential improvement area in alliancing fuel efficiency comes from the increased load factors associated with pooling. Pooling involves sharing requirements to optimize load factors. Gagnepain and Marin (2007) conclude that airline alliances are able to lower prices because they result in lower costs.

Organizational culture is not a dynamic capability, but meets the valuable, rare, inimitable and non-substitutable requirements of a resource based view. Barney (1986) suggests that organizational culture may be a source for sustained competitive advantage. Achieving a fuel efficiency focused organizational culture involves the integration of the importance of fuel efficiency as a core ingredient to the success of the organization. Embedding fuel efficiency into an organizational culture is difficult (Hatch, 1993).

TABLE 1
AVIATION INDUSTRY STRATEGIC DECISION MAKING FOR FUEL EFFICIENCY

<table>
<tr><th colspan="6">Strategic Decision Making</th></tr>
<tr><th colspan="4">Strategic Investment</th><th colspan="2">Strategic Planning</th></tr>
<tr><th>Aircraft Acquisition</th><th>Automation and Optimization Software Acquisition</th><th>Ground Equipment Acquisition</th><th>Infrastructure Improvements</th><th>Location Management</th><th>Process</th></tr>
<tr><td>More Fuel Efficient Engines</td><td rowspan="4">Route and Schedule Optimization for Enterprise Requirements at Minimum Cost of Fuel and Assets</td><td rowspan="2">Mission Handling Equipment Fuel Efficiency</td><td rowspan="2">Strengthening a Runway to Increase Load Factors</td><td>Aircraft Basing</td><td rowspan="2">Initial Process Design for Fuel Efficiency</td></tr>
<tr><td>Lighter Materials and Components</td><td>Ground Equipment Locations</td></tr>
<tr><td>Enhanced Aerodynamics</td><td rowspan="2">Mission Support Equipment Fuel Efficiency</td><td rowspan="2">Lengthening a Runway to Increase Load Factors</td><td>Facility Locations</td><td>Process Redesign for Fuel Efficiency</td></tr>
<tr><td>Optimal Fleet Mix for Fuel Efficiency</td><td>Maintenance Repair Capability</td><td>Accountability for Fuel Efficiency</td></tr>
</table>

Schein (1984) stressed the importance of the structure of the firm and the firm's reward system during the development of organizational culture. The process to embed fuel efficiency into the culture requires measuring individual contribution to fuel efficiency and then establishing mechanisms that utilize that contribution element as an important consideration for promotion/reward. Leadership involvement is also critical toward embedding fuel efficiency in the organizational culture. Fuel efficiency should be incorporated into leadership communications to employees. Organizationally, a top executive can be assigned to oversee a firm's overall fuel efficiency effort. A committee can also be established among top executives to discuss strategic fuel efficiency opportunities.

Operational fuel efficiency can be greatly enhanced by fuel efficiency strategic decision making, supply chain fuel efficiency and an organizational culture committed to fuel efficiency. To align all of these sources of competitive advantage together requires fuel efficiency metrics. These metrics need to be measured, analyzed and reported to key decision makers. Accountability for metric performance must be established in terms of both individual promotion/reward and fuel efficiency trends needing management attention. The metrics should be designed to influence positive behaviors and issues where negative behaviors, can positively impact a metric should be highlighted and widely acknowledged.

FUEL EFFICIENCY INDEX

Fuel efficiency metrics in the transportation industry are based upon several aggregate measures of output. In the aviation industry, the Bureau of Transportation Statistics includes air revenue ton miles and air revenue passenger miles (Lahiri et al, 2003). Internationally, revenue ton kilometers and revenue passenger kilometers are used (Owen, 2008). Assuming an increase in these metrics is positive then increasing revenues, distances and load factors would result in a positive trend. The desired objective of fuel efficiency is to move the greatest quantity of cargo and passengers at the least cost of fuel for a given distance, set of assets and unit of time.

Ton miles and passenger miles should measure the Great Circle Distance (GCD) between cargo and passenger onload and offload as established in Federal Regulations (Code of Federal Regulations, 2010). Including GCD in the

metric would allow the flight of more miles to save fuel overall. Flying greater distances can save fuel. Examples include flying farther to find more favorable winds or flying farther to obtain an Air Traffic Control routing that allows for a higher, more fuel efficient altitude. Ton miles and passenger miles still fail to take into account fuel, so those metrics should be divided by fuel used. The literature includes many examples where fuel is incorporated with passenger distance and cargo weight distance (Lee et al, 2004; Hileman et al, 2008; Owen, 2008; Rutherford and Zeinali, 2009). Ton miles per lbs of fuel consumed and passenger miles per lbs of fuel consumed consider fuel and mass transported over a given distance.

Hileman et al (2008) labeled these metrics Payload Fuel Energy Efficiency (PFEE), but uses fuel energy consumed instead of lbs of fuel consumed. This metric excels as an aggregate measure, but fails to take into account how an increasing quantity of sorties can tend to increase the measure of efficiency. For example, if two sorties are performed exactly the same, then the aggregate PFEE of both sorties is twice the size for the PFEE of one sortie. The reason for this is that both variables in Hileman et al's metric numerator are doubled while only one term in the denominator is doubled. This effect of increasing efficiency by increasing sorties is eliminated by obtaining the sortie average. Including the number of sorties n in the denominator of PFEE operationalizes the Fuel Efficiency Index (FEI) metric as seen in equations (1) and (2).

$$Cargo\ FEI = \frac{\sum_{i=1}^{n} \frac{Tons_i * Miles(GCD)_i}{KLbs\ of\ Fuel\ Burned_i}}{n}, where\ n = \#\ of\ sorties \quad (1)$$

$$Passenger\ FEI = \frac{\sum_{i=1}^{n} \frac{Passengers_i * Miles(GCD)_i}{KLbs\ of\ Fuel\ Burned_i}}{n}, where\ n = \#\ of\ sorties \quad (2)$$

TABLE 2
AIR MOBILITY COMMAND FEI BY MDS NOVEMBER 2010

	Sorties	Great Circle Distance (Nautical Miles)	Cargo (Tons)	Fuel Consumed (1000 lbs)	Fuel Efficiency Index: (GCD*Cargo)/ (FC*Sorties)
C-17A	3110	4471385	54406.05	220724	354
C-5A	74	133192	1781.5	8141	394
C-5B	251	542520	7494.2	31936	507
C-5M	4	10375	116.25	549	550
C-130E	317	64456	860.55	1661	105
C-130H	675	280850	2562.7	6492	164
C-130J	188	145918	831.45	2587	249
KC-10A	107	186420	288.95	14955	34
KC-135R	358	494280	459.05	26663	24
KC-135T	60	74927	49.1	5265	12
Total	5144	6404322.45	68849.8	318971	269

THE DATA

Babikian et al. (2001) demonstrated that efficiency differences between regional and large aircraft can be affected by sortie length. As the proportion of large and small aircraft changes over time, the overall FEI can be biased. To remove this bias, the FEI in equations (1) and (2) can be calculated on an aircraft type basis to remove the bias of different aircraft type ratios impacting the overall efficiency metric. To obtain a better understanding of the fuel efficiency index, 5,144 Air Mobility Command military airlift sorties from November 2010 were analyzed with respect to the proposed index. Only channel, contingency or special assignment airlift mission sorties were selected. A summary of the index numbers broken down by aircraft Mission Design Series (MDS) can be seen in Table 2.

Note how the larger aircraft tend to have on average better FEI scores with the C-5M scoring highest. This trend for larger aircraft matches Babikian et al's results. Tanker aircraft (KC-10 and KC-135) tend to have very low FEI scores due to the limited cargo they carry and also due to the fact that airlift is ancillary to their primary mission of air refueling. The overall efficiency numbers are at the lower end of their range due to the prevalence of sorties with no cargo. Of all the sorties observed, 22% had no cargo. Sorties at the top of the efficiency range had FEI measuring in the thousands. Table 3 includes the descriptive statistics for all of the FEIs.

From the descriptive statistics, note that the standard deviation is larger than the mean. This suggests a large dispersal of the data. There are a few outliers at the top of the range that are associated with bad data. A couple of cases included diverts back to the origin, but failed to change the city pair. This resulted in extremely low fuel usage for a long distance resulting in a false FEI. In the cases of diverts, it is important to record the destination as the same as the origin. Finally, the mean is much larger than the median suggesting influence by a few outliers at the top of the range.

GREAT CIRCLE DISTANCE

After examining the descriptive statistics of FEI, the data was analyzed to assess the impact of great circle distance. If greater distances lead to better FEIs, than shifting the fleet to more long distance missions might improve the FEI measure. Increased distance tends to decrease payload capacity. This can be seen in Breguet Range equation (3) (Lee et al, 2004). V is the flight speed, L/D is the lift to drag ratio, g is the gravitational acceleration constant, SFC is specific fuel consumption and W is weight. The equation shows a tradeoff between fuel weight and payload weight.

$$R = \frac{V\left(\frac{L}{D}\right)}{g * SFC} * \ln\left(1 + \frac{W_{fuel}}{W_{payload} * W_{structure} * W_{reserve}}\right) \quad (3)$$

If Air Mobility Command aircraft were operating at maximum payload, then as distance increases, payload decreases counteracting the increase in FEI. When not operating at maximum payload, similar payloads will result in a higher FEI for aircraft that move the cargo farther. To isolate the bias of differing MDS aircraft, the

TABLE 3
DESCRIPTIVE STATISTICS FOR AIR MOBILITY COMMAND FEI
NOVEMBER 2010

Mean FEI	267.41
Standard Deviation	332.32
Minimum	0
Maximum	5188.57
Count	5144

FIGURE 2
C-17 GREAT CIRCLE DISTANCE AND FEI

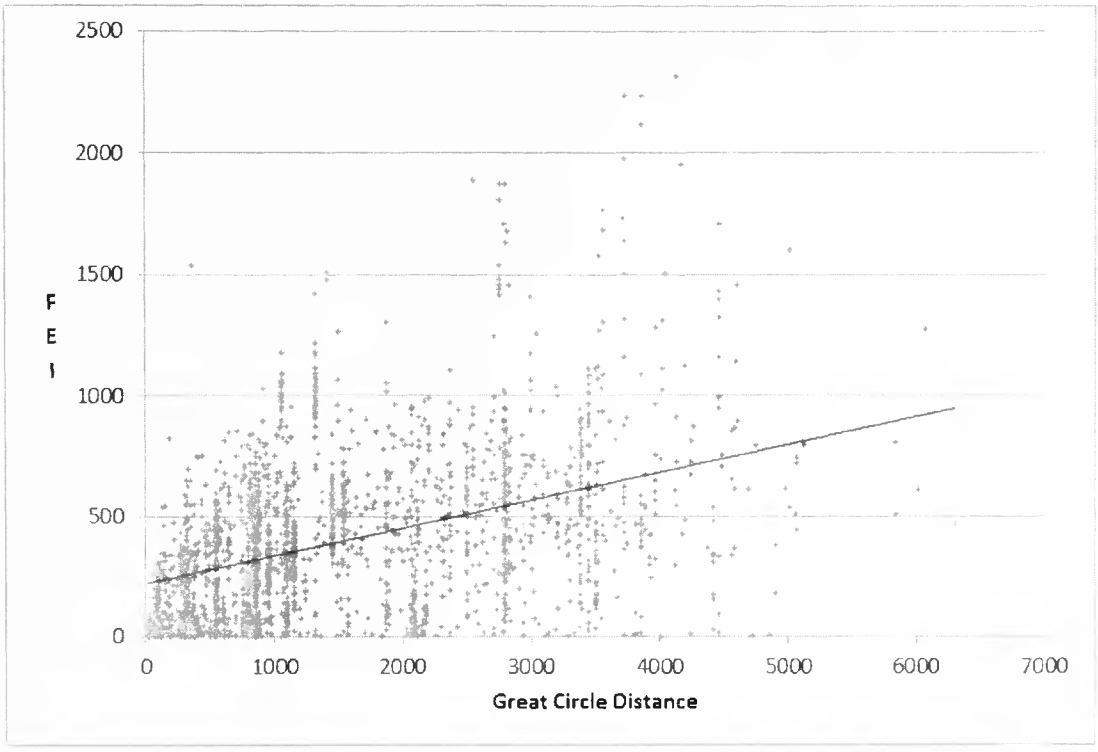
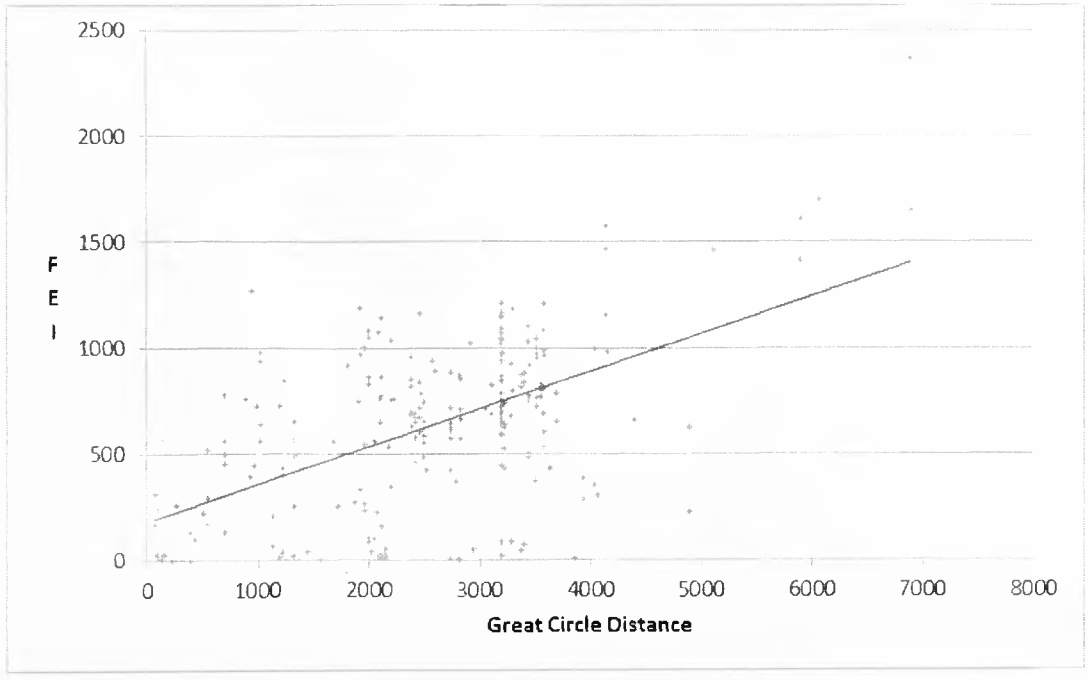


FIGURE 3
C-5 GREAT CIRCLE DISTANCE AND FEI



comparison of distance to FEI was made for the C-17 and the C-5. For the C-5, the A, B and M models were included together. The results were plotted in Figures 2 and 3.

Both of the plots show an increase in FEI for longer distance city pairs. The overall correlation between GCD and FEI is 44%. The only method that a manager could use to increase GCD is to overfly an intermediate location or discover longer distance city pairs to replace city pairs currently being used. If these sorties were operating at maximum payload before the transition, than a payload penalty would exist for going to longer distances. Yet, if the sorties were flying with a suboptimal payload, then they could fly a longer range with the same payload and increase FEI.

LOAD FACTORS

To enhance the effectiveness of the FEI, it should be reported along with load factors. The benefit of the load factor is that it is a ratio of the actual load to the optimal load. This information provides important insight into how cargo loading efficiency influences FEI. Load factors can have two limiting factors. These factors include weight limitations and volume limitations. The volume limitation or cube is a matter of dimension. It is based on the surface area of the cargo floor and the height of the cargo door. It is often measured as a ratio of pallet positions used over pallet positions available. If a cargo compartment is cubed out (pallet positions used equals pallet positions available) and cargo of greater density is not available (assuming below payload maximum) then the horizontal optimal configuration was achieved. In order to achieve optimality for the vertical, a metric should be added for the load factor of the pallet. It should be noted that calculating pallet load factors could be complex if accuracy is a primary concern. To simplify pallet load factors, a ratio of the height of the pallet to the maximum allowable height might be preferable.

The weight limitation is more complex. Pallets and aircraft cargo floors have a weight limitation. The limits of these must be observed. The aircraft also has a maximum gross takeoff weight which is dependent upon several variables. The first constraint is an airframe limit. This airframe limit can be reduced based upon several variables. These variables include pavement strength, runway length, altitude, temperature, obstacles and runway winds. With the maximum gross weight for takeoff determined, cargo available equals maximum gross takeoff weight minus operating weight minus fuel on board. The fuel on board is a calculation based on many factors.

The primary factor is the distance to the next fueling point. Other considerations include icing, thunderstorms, weather at origin and destination, distance to alternate, airframe specific fuel degrade, cargo weight, routing, altitude and winds. Due to the complexity of all of these factors, determination of the exact maximum payload is extremely difficult and often requires iterative algorithms. Computer flight planning software can calculate the value of payload maximum (PMAX) and those values should be calculated and recorded for every sortie flown. For passengers, the load factor is based on percentage of seats filled. See equations (4), (5), (6), (7) and (8) for load factors. The behaviors desired from these metrics include maximizing the pallet loads and completely filling the aircraft.

$$Pallet\ Load\ Factor\ (Cube) = \frac{Actual\ Pallet\ Volume}{Maximum\ Pallet\ Volume}\ or\ \frac{Actual\ Pallet\ Height}{Maximum\ Pallet\ Height} \quad (4)$$

$$Pallet\ Load\ Factor\ (Weight) = \frac{Actual\ Pallet\ Weight}{Maximum\ Pallet\ Weight} \quad (5)$$

$$Load\ Factor\ (Cube) = \frac{Pallet\ Position\ Equivalents\ Used}{Pallet\ Positions\ Available\ (MDS\ Specific)} \quad (6)$$

$$Load\ Factor\ (Weight) = \frac{Actual\ Cargo\ Weight}{Computer\ Flight\ Plan\ computed\ Payload\ Maximum} \quad (7)$$

$$Passenger\ Load\ Factor = \frac{Actual\ Passengers}{Available\ Seats} \quad (8)$$

Load factors for passengers in the aviation industry grew from 60 to 80% from 1990 to 2008 and load factors for commercial cargo remained flat around 60% over the same time period (Hileman et al, 2008). To contrast against industry data, load factors for the Air Mobility Command data set were gathered. Payload maximum was determined using equation (9). Actual ramp fuel was used to aid in simplification, but operationally the load factors need to be determined before the ramp fuel is loaded. Payload maximum is not routinely used by Air Mobility Command's command and control staff, but its value is critical to accurate load factor determination during planning. Payload maximum is dependent on Maximum Gross Takeoff Weight. For the analysis, the Maximum Gross Takeoff Weight used was the maximum for the aircraft. Other variables that could further reduce Maximum Gross Takeoff Weight include airfield pavement strength limitations and departure obstacles. Their inclusion would serve to improve load factors. The cargo load factors for Air Mobility Command can be seen in Table 4. The Air Mobility Command cargo load factor is lower

$$Payload_{Max} = [Min\ Payload_{Acft\ Max}, (W_{Max\ Gross\ Takeoff} - W_{Ramp\ Fuel} - W_{Operating})] \quad (9)$$

TABLE 4
AIR MOBILITY COMMAND LOAD FACTOR NOVEMBER 2010

	Maximum Gross Takeoff Weight	Empty Weight	Load Factors
C-17A	585	282.5	23%
C-5A	769	380	23%
C-5B	769	380	31%
C-5M	769	380	28%
C-130E	155	90	15%
C-130H	155	90	21%
C-130J	155	90	27%
KC-10A	590	241	3%
KC-135R	322.5	119.23	3%
KC-135T	322.5	119.23	2%
Total			22%

FIGURE 4
C-17 LOAD FACTOR AND FEI

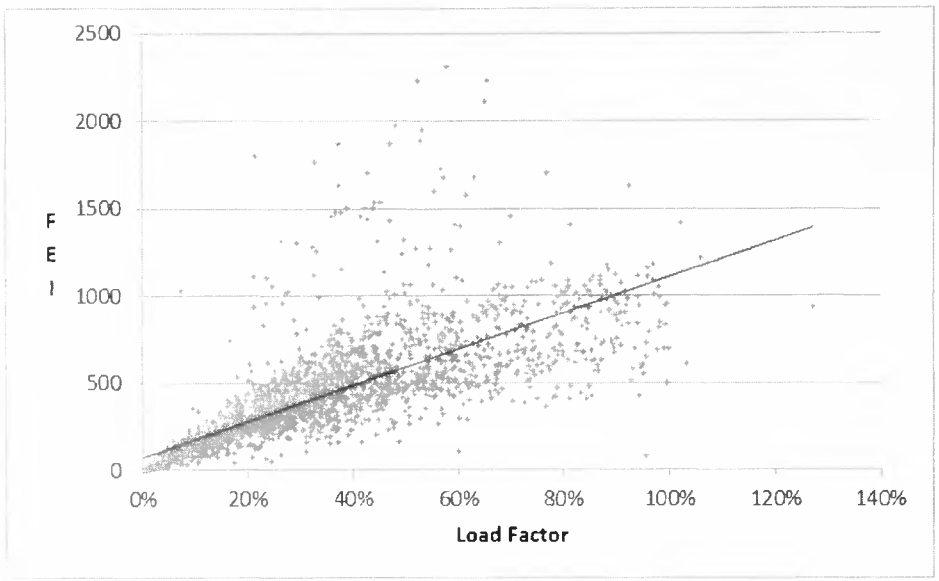
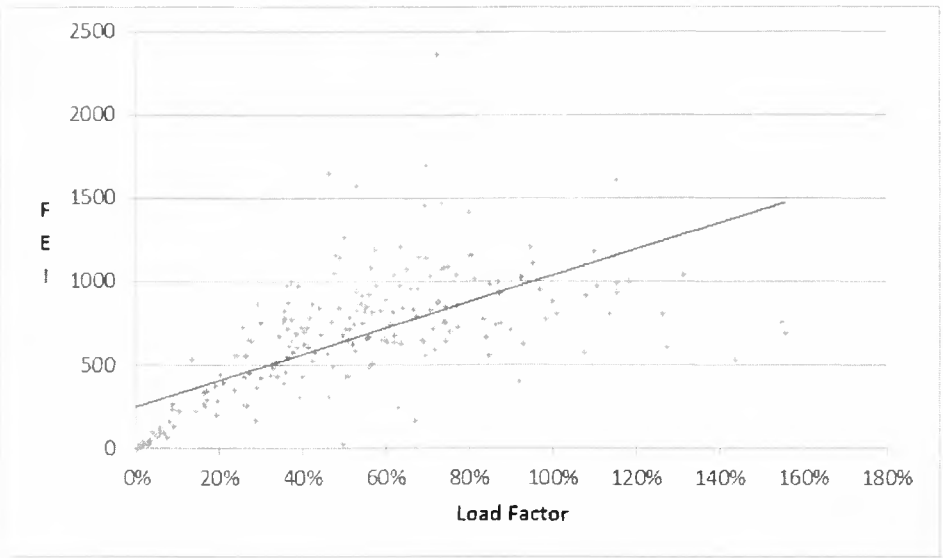


FIGURE 5
C-5 LOAD FACTOR AND FEI



than industry by a factor of 3. This illustrates the need for the operationalization of the load factor metric into Air Mobility Command planning, command and control. Each sortie's load factor needs to be highlighted when the value falls below a firm's specific threshold. Load factor feedback control systems can have a positive impact on the fuel efficient operation of the enterprise.

Strategic airlift airframes were selected from the data for more detailed analysis. To better understand the impact of load factors on FEI, load factors were plotted against FEI for both the C-17 and the C-5 as seen in Figures 4 and 5. In both cases, a positive correlation is seen between increasing load factors and the FEI. Overall, there exists a 74% correlation between load factor and FEI. This is almost twice as large as the 44% correlation with GCD. There are several data points outside 100% load factors. These are suspected to be due to waivers that allow for loading more cargo than Maximum Gross Takeoff Weight. One other item of note is the increasing variance of FEI as load factors increase. This was also apparent in the analysis of GCD.

INACTIVE SORTIES

Aircraft often need to reposition to pick up cargo and deposition after delivering cargo. This reduces load factors by driving up the number of no cargo sorties. It also reduces FEI due to the zeroing of the numerator. Inactive sorties drive the desire to either stage aircraft out of heavy cargo and passenger requirement locations or to select aircraft that are nearest to the cargo and passenger requirement onload or offload locations. A metric that is proposed to handle the efficiency of aircraft selection to meet this requirement is inactive miles per inactive sortie as seen in equation (10). An inactive mile is defined as a mile flown to position an aircraft at a cargo onload location or to deposition an aircraft from a cargo offload location. An inactive sortie is a sortie composed of inactive miles. The behavior desired is to drive aircraft staging to where the cargo is located or to select an aircraft for a mission that is closest to the cargo onload and offload.

TABLE 5
AIR MOBILITY COMMAND INACTIVE MILES PER SORTIE NOVEMBER 2010

	Inactive Sorties	Inactive Miles	Inactive Miles Per Sortie
C-17A	960	1186113	1236
C-5A	33	27453	832
C-5B	98	129808	1325
C-5M	2	5188	2594
C-130E	40	18876	472
C-130H	49	47441	968
C-130J	31	29748	960
KC-10A	37	88638	2396
KC-135R	77	163989	2130
KC-135T	7	7493	1070
Average			1398

$$Inactive\ Miles\ per\ Sortie = \frac{\sum_{i=1}^{n} Inactive\ Miles_i}{n},$$

$$where\ n = \#\ of\ inactive\ sorties \tag{10}$$

FIGURE 6
C-17 FUEL CONSUMED AND FEI

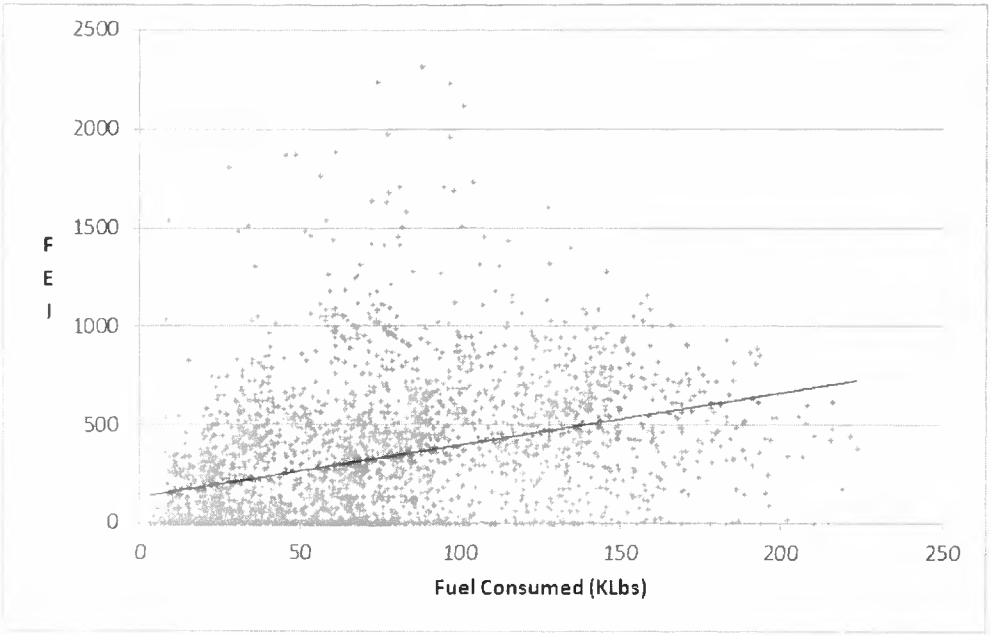
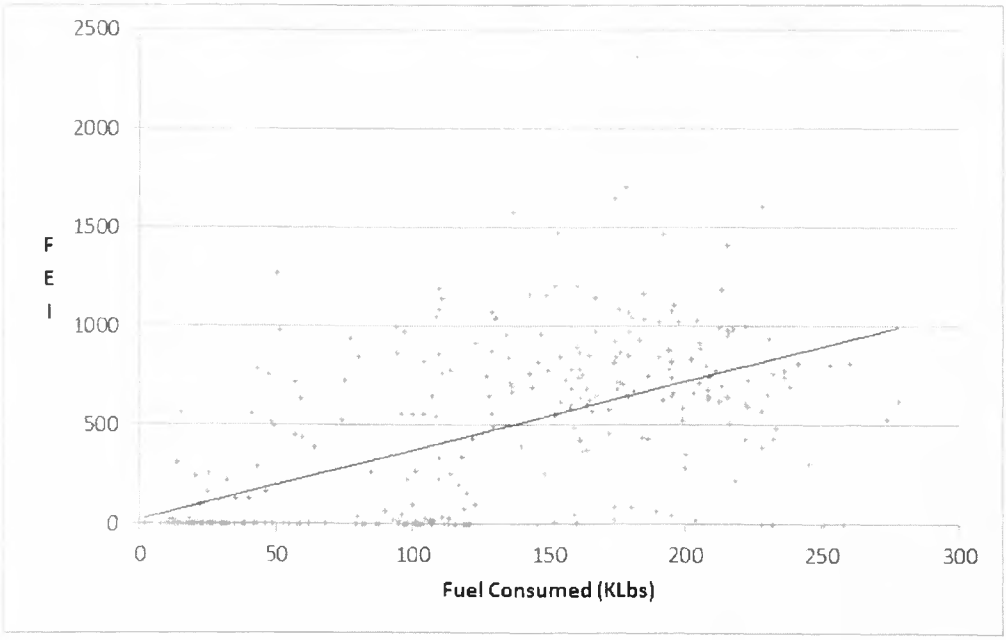


FIGURE 7
C-5 FUEL CONSUMED AND FEI



The results of the inactive miles per sortie analysis on an MDS basis for Air Mobility Command can be seen in Table 5. The tankers have to travel the longest to get their requirements. Inactive miles appear to decrease with aircraft size after that. Although this metric is broken down on a per MDS basis, it could be analyzed on a departure airfield basis to discover which units have the farthest to travel for positioning and depositioning. From these results, insights into potential staging opportunities could be an area for further research.

FUEL

After examination of the effects of Great Circle Distance and Load Factors on FEI, the final variable that is part of FEI is fuel consumed. An examination of fuel consumed against FEI was plotted in Figures 6 and 7. To aid in visibility for the C-17 plot, three outliers were removed. The expected behavior is that as fuel consumed increases, FEI should decrease. The opposite occurs in actuality. There are two suspected reasons for this. First, there is a 78% correlation between GCD and fuel consumed and the FEI increase associated with increasing GCD outweighs the additional fuel burned. Second, sorties with higher load factors burn more fuel. A potential solution to provide greater sensitivity to fuel consumed would be to square the fuel consumed in the denominator of the FEI equation.

When extra fuel is carried on board an aircraft, the added weight of that fuel burns additional fuel unnecessarily. Due to this cost of carrying additional fuel, it is often desired to ensure that no more fuel is added to a mission than planned. This illustrates the need for a metric that represents fueling accuracy as seen in equation (11). In addition to reducing the cost to carry fuel, it is often desired to have the aircraft fly the most fuel efficient flight profile. This is

$$Fueling\ Accuracy = Max\left(0, Min\left(1{,}1 - \frac{actual\ fuel\ load - planned\ fuel\ load}{planned\ fuel\ load}\right)\right) \quad (11)$$

$$Fuel\ Burn\ Ratio = \frac{planned\ fuel\ burn}{actual\ fuel\ burn} \quad (12)$$

TABLE 6
FUELING ACCURACY AND FUEL BURN RATIO

	Average Fueling Accuracy	Average Fuel Burn Ratio
C-17A	97%	1.03
C-5A	95%	0.98
C-5B	98%	0.98
C-5M	100%	1.02
C-130E	100%	1.00
C-130H	99%	1.01
C-130J	93%	1.11
KC-10A	96%	0.98
KC-135R	92%	1.00
KC-135T	97%	1.00

complicated by load factors and distances involved. To remove these and other sortie specific factors, a contrast could be made between a planned fuel burn and the actual fuel burn. To drive this behavior, equation (12) measures a planned over actual fuel burn ratio. The goal of the metric is to maximize the ratio by minimizing actual fuel burn.

Differences between planned and actual fuel burn are subject to multiple variables. Many of these variables are outside of the pilot's control while some can be manipulated. Variables outside of the pilot's control include winds different than planned, achievable altitude below planned, icing/thunderstorms/turbulence altering routings and/or altitude and decreased engine performance. Variables within the pilot's control include throttle setting, not flying planned routings and altitudes (not influenced by external constraints) and climb/descent profiles. Since the ratio of planned fuel burn to actual fuel burn does not distinguish between aspects of fuel burn that are within the pilot's locus of control, the metric could be unjustly punitive. Despite this drawback, the metric does distinguish discrepancies from planned fuel burn and drives behavior to lower fuel burn. Air Mobility Command data for average fueling accuracy and average fuel burn by aircraft can be seen in Table 6.

From the table, note the high fueling accuracies. These high accuracies are due to the way the planned ramp fuel is calculated. The Air Mobility Command Fuel Data Tracker will set the planned ramp fuel equal to actual ramp fuel if the ramp fuel deviation reason was outside of the pilot's control. This aids in unjust attribution, but skews the data toward the high end of accuracy. The fuel burn ratio provides little information from an aircraft perspective. It might suggest something about the quality of the fuel planning or it could be a sign of something cultural in that aircraft's community. The fuel burn ratio could be more effectively used by comparing organizational units. It could also be used to compare pilots.

MANAGERIAL IMPLICATIONS FOR CITY PAIR ANALYSIS

FEI increased with GCD, load factor and fuel consumed. To get a better understanding of the sensitivity of FEI to load factor and fuel consumed, a specific city pair was selected.

FIGURE 8
KDOV-ETAR C-17 LOAD FACTORS AND FEI

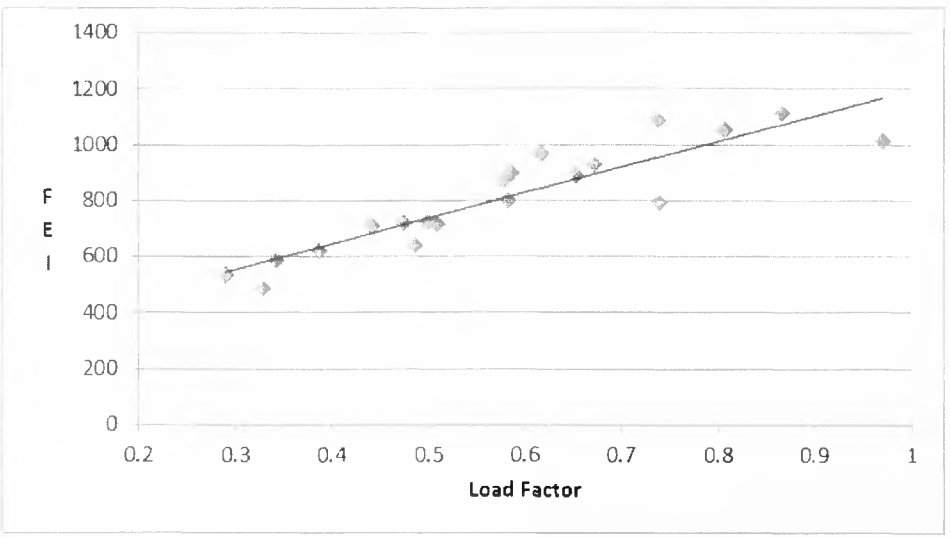
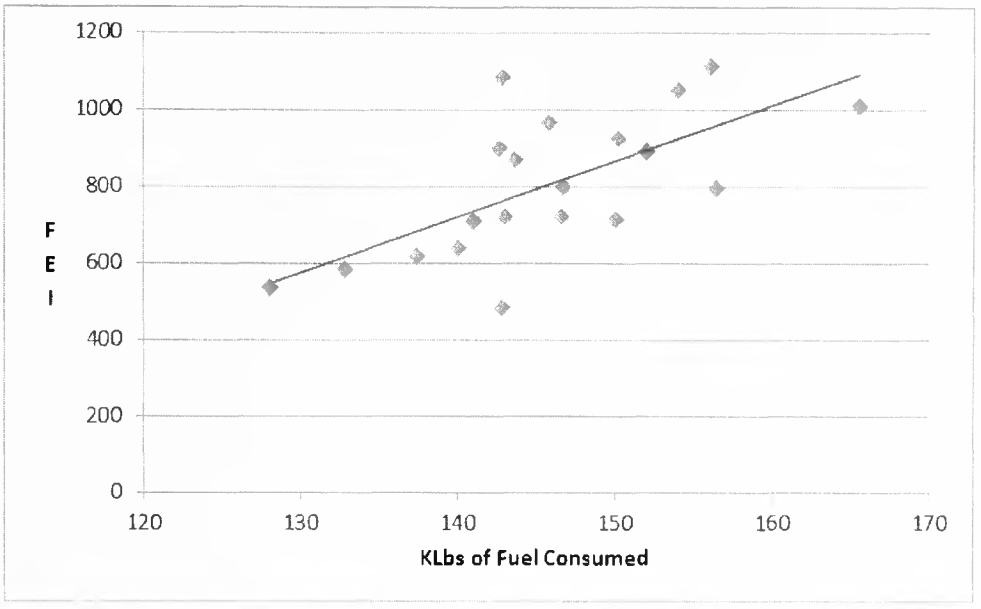


FIGURE 9
KDOV-ETAR C-17 FUEL CONSUMED AND FEI



This enabled distance to become constant leaving cargo and fuel as the remaining variables. Dover to Ramstein was a common city pair in the data set with 20 observations. Note that managing FEI by city pair might be time consuming and effort should be concentrated on frequent city pairs. C-17s were selected for the analysis to further constrain the variables by limiting aircraft type. The results can be seen in Figures 8 and 9.

Figure 8 shows how the amount of fuel consumed varies for a fixed distance and load factor, while Figure 9 shows how the amount of cargo varies for a fixed distance and fuel consumed. The Figure 8 relationship is useful for managers in that it identifies sorties that deviate from previous observations based on fuel efficiency. The ability to identify sorties that exceed a predetermined interval on the regression of that city pair could highlight outliers in both fuel efficiency and fuel inefficiency. In depth analysis of those outliers in terms of root cause could expose opportunities for greater fuel efficiency. Specific aircraft tails or aircrews might repeatedly occur outside the interval representing the need for possible remedial action.

From Figure 8, note the tight scatter of points about the simple linear regression. The R^2 for this regression is .82. This indicates that load factor when constricted by city pair explains most of the variability in FEI. Figure 8 also aids in understanding that to target an FEI near 1000 requires an 80% load factor. From Figure 9, note that the points have much greater variance about the line. The R^2 for this regression is .45. This indicates that fuel consumed when constricted by city pair explains only 45% of the variability in FEI. Taking a vertical slice of Figure 8 shows load factor replicates with the variance between the data points being explained by fuel consumed. Using a band about the regression line for a city pair in Figure 8 could highlight missions that consume too much or too little fuel contrasted against the aggregate. Further analysis into those missions could potentially highlight fuel savings opportunities.

INCORPORATING METRICS INTO THE AVIATION INDUSTRY FUEL EFFICIENCY MODEL

Application of FEI operationally can drive desired behaviors to increase load factors, reduce inactive miles and reduce fuel usage. Reducing fuel consumption might best be addressed through the banding method of the regression line in the Dover to Ramstein example. FEI has value beyond operational application. To obtain the optimal value from FEI, the metric should be applied to all of the components of the Aviation Industry Fuel Efficiency model. The first component of the model requiring the application of FEI is strategic decision making. FEI should be implemented in both the strategic investment and strategic planning components of strategic decision making,

From a strategic investment perspective, the FEI metric can drive aircraft acquisition requirements and allow for innovative paradigm shifts. The FEI minimum for several set distances can be specified as the requirement. Since FEI does not include time as a variable, that should be constrained to a set maximum when building the requirement to avoid solutions that are too slow. FEI also fails to address reliability. The C-5 has superior FEI on average, but suffers from reliability issues. This needs to be addressed when making strategic investments such as aircraft acquisition. Larger aircraft might be superior in terms of FEI, but might suffer mechanically due to their size and complexity. Infrastructure improvements enhancing load factor potential such as pavement strengthening can be assessed based upon FEI impact. Strategic airfield improvements could result in increased cargo flow and more efficient operations. Ranking airfield improvement projects by FEI impact can be an important factor when considering prioritization.

Beyond strategic investment, FEI could be extremely useful in strategic planning. FEI and inactive miles would be very useful for the determination of aircraft basing and staging locations. Those metrics would also be very useful from a theory of constraints perspective by highlighting the least efficient aircraft and mission pairings. Automatically calculating the FEI planning metric once an aircraft has been assigned to the mission and highlighting poor FEIs and inactive miles could provide planning and aircraft allocation functions immediate feedback for correction. Individual planners and aircraft allocators can be held accountable using FEI and inactive miles as performance metrics. Beyond individuals, organizational goals can be established regarding both the FEI and inactive miles.

Implementation of the FEI should extend beyond the firm when the FEI is dependent upon other firms in the supply chain. Suppliers performing functions such as warehousing and distribution that are tied to air mobility should be provided information on their FEI impact. In addition, strategic partnering should be encouraged to enhance load factors. Alliances should be examined that offer the greatest potential to increase the FEI. Shared investments on information technology, automated identification and tracking and cargo distribution equipment might offer FEI improvements that justify the acquisition. Suppliers need to be properly rewarded for their investments to enhance FEI.

Strategic decision making and supply chain fuel efficiency can be greatly improved through the use of the FEI. Yet, there are areas of improvement in FEI that can only be achieved by those operational workers executing the process. To reap those benefits, FEI needs to be embedded into organizational culture. Attempting to embed a metric into organizational culture and simultaneously using the metric as a tool for accountability is difficult. The problem is that individuals tend to rebel against punitive metrics. For acceptance, it is preferred to use the metric in a positive role until it becomes accepted as part of the organization. It is important to include the metric when

measuring operations at every level. Obtaining leadership support for the metric is essential. FEI needs to be presented at senior level meetings and included in organizational goals. Finally, FEI should be part of the reward structure for promotion for factors within the individual's control. This could include individual awards for sustained high FEI performance to highlighting the metric during promotion discussions.

FINDINGS AND CONCLUSION

The Aviation Industry Fuel Efficiency model presents a framework for transforming fuel efficiency into a sustained competitive advantage. This is achieved through the use of the dynamic capabilities of strategic decision making and alliancing. In addition to those dynamic capabilities, the model recommends ingraining fuel efficiency into the organizational culture. To assist the manager in implementing the model, the FEI was introduced. The FEI drives desired behaviors to increase load factors, decrease inactive miles and reduce fuel consumed. Other metrics were suggested to further assist the manager in improving fuel efficiency behaviors to include load factors, inactive miles per sortie, fueling accuracy and fuel burn ratio. It is important to measure load factors from both a weight and cube perspective, to obtain a better understanding of the efficiency of operations.

Measuring FEI operationally can drive behaviors toward increased fuel efficiency, but application of the FEI to the model is where a firm can leverage much greater fuel efficiency benefits. Extending the FEI to strategic decision making, supply chain partners and the organizational culture will allow the firm's fuel efficiency focused resources to not be easily imitated. There are certain risks associated with greater fuel efficiency integration within the supply chain and strategic fuel efficiency investments. These risks need to be thoroughly analyzed. There are also risks to not integrating or not investing in an environment of rising fuel prices. Following a fuel efficiency strategy will make the firm and the firm's supply chain less susceptible to rising fuel prices. A fuel efficiency strategy will also increase a firm's ability to compete on price.

The FEI ties together all of the components of the model. It enables individual, organizational, corporate, supply chain and industry goals to align. This common sense of purpose can only be achieved if the metric is valued equally. FEI could support aircraft manufacturers, distribution centers, command information systems, planning systems and allocation. Much as a low cost retailer is less susceptible to economic downturns, a fuel efficient firm in the aviation industry is less susceptible to fuel price increases. A fuel efficiency strategy is a risk reduction strategy with opportunities for expert practitioners to obtain a sustained competitive advantage.

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Journal of Transportation Management

Guidelines for Submission/Publication

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2. Articles should be submitted electronically to Dr. Taylor at taylorjohn@wayne.edu.

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Book Chapter:
Manrodt, Karl (2003), "Drivers of Logistics Excellence: Implications for Carriers," In J. W. Wilson (Ed.), *Logistics and Transportation Research Yearbook 2003* (pp. 126-154) Englewood Cliffs, NJ: Prentice-Hall, Inc.

Book:
Coyle, John J., Bardi, Edward J., and Novack, RobertA. (2004), *Transportation,* 6th ed., Cincinnati, OH: South-Western College Publishing.

Website:
Wilson, J. W. (2003), "Adapting to the Threat of Global Terrorism: Reinventing Your Supply Chain," [On-line]. Available: http//:georgiasouthern.edu/coba/centers/lit/threat.doc. Created: 11/01/02, Accessed: 11/12/03.

MANUSCRIPT SAMPLE

A FRAMEWORK FOR EVALUATING SUPPLY CHAIN PERFORMANCE

Terrance L. Pohlen, University of North Texas

ABSTRACT

Managers require measures spanning multiple enterprises to increase supply chain competitiveness and to increase the value delivered to the end-customer. Despite the need for supply chain metrics, there is little evidence that any firms are successfully measuring and evaluating inter-firm performance. Existing measures continue to capture intrafirm performance and focus on traditional measures. The lack of a framework to simultaneously measure and translate inter-firm performance into value creation has largely contributed to this situation. This article presents a framework that overcomes these shortcomings by measuring performance across multiple firms and translating supply chain performance into shareholder value.

INTRODUCTION

The ability to measure supply chain performance remains an elusive goal for managers in most companies. Few have implemented supply chain management or have visibility of performance across multiple companies (Supply Chain Solutions, 1998; Keeler et al., 1999; Simatupang and

Sridharan, 2002). Supply chain management itself lacks a widely accepted definition (Akkermans, 1999), and many managers substitute the term for logistics or supplier management (Lambert and Pohlen, 2001). As a result, performance measurement tends to be functionally or internally focused and does not capture supply chain performance (Gilmour, 1999; *Supply Chain Management,* 200 I) . At best, existing measures only capture how immediate upstream suppliers and downstream customers drive performance within a single firm.

Table 1 about here

Developing and Costing Performance Measures

ABC is a technique for assigning the direct and indirect resources of a firm to the activities consuming the resources and subsequently tracing the cost of performing these activities to the products, customers, or supply chains consuming the activities (La Londe and Pohlen, 1996). An activity-based approach increases costing accuracy by using multiple drivers to assign costs whereas traditional cost accounting frequently relies on a very limited number of allocation bases.

$y = a^2 - 2ax - x^2$

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